

REFUTATION

OF THE NUMEROUS

MISTATEMENTS AND FALLACIES

CONTAINED IN

A PAPER PRESENTED TO THE ADMIRALTY

BY

DR. THOMAS YOUNG,

(SUPERINTENDENT OF THE NAUTICAL ALMANAC,)

AND PRINTED

BY ORDER OF THE HOUSE OF COMMONS:

DATED 17TH MARCH, 1829.

BY JAMES SOUTH, F.R.S.

“ O magna vis Veritatis, quæ contra hominum ingenia, calliditatem, sollertiam, contraque fictas omnium insidias, facîle per seipsam defendat ! ” — CIC. *pro M. Cælio*.

LONDON:

PRINTED BY

J. MOYES, TOOK'S COURT, CHANCERY LANE.

1829.



P R E F A C E.

IN the month of January last, an application was made to His Grace the Duke of Wellington, as First Minister of the Crown, respecting the inefficient state of the *Nautical Almanac*. His Grace, some few days afterwards, referred the matter, for examination, to the Chancellor of the Exchequer; in consequence of which, the individuals with whom the application originated were introduced to that Right Honourable Gentleman on the 28th of January. In order to ensure a full and fair investigation of this important subject, a written outline of the statements made at this conference was shortly afterwards forwarded to the Chancellor of the Exchequer, at his desire.

On the 23d of February following, an Honourable Member of the House of Commons moved for “a copy of any MEMORIALS or REPORTS presented to Government since the 1st of January, 1828, on the subject of the NAUTICAL ALMANAC, or the BOARD of LONGITUDE;—also, A RETURN of the expenses of the late Board of Longitude, classed under the principal heads, and distinguishing each year, from the establishment of the Board of Longitude in 1818, until its dissolution.”

The above papers were produced, and were, on the 17th of March, ordered by the House of Commons to be printed.

This printed document contains a Memorandum of a Statement made to the Chancellor of the Exchequer, on the 28th of January, relative to the expediency of reforming the Nautical Almanac, and establishing a new Board of Longitude; secondly, a copy of a Paper read at a meeting of the Board of Longitude, held April 5, 1827, and ordered to be printed for the use of the members, signed J. F. W. Herschel; thirdly, a Report on a Memorandum of a Plan for reforming the Nautical Almanac, signed Thomas Young, Superintendent of the Nautical Almanac; and, fourthly, an account of the expenses of the late Board of Longitude, signed Thomas Young, M.D., late Secretary of the Board.

In the above "Report" by Dr. Thomas Young, as Superintendent of the Nautical Almanac, he has quoted, or rather inferred, from the Memorandum, certain "Objections," to which he has subjoined his "Answers." He has also availed himself of the opportunity to reply to charges elsewhere brought against the Nautical Almanac by Mr. Baily and myself. To me he has alluded in no very ambiguous terms, although he has avoided the actual use of my name. But feeling that the plausibility of his "Answers,"—or, as they might be designated, his Defence,—may mislead some of those whom it ought to have been his object, and was his duty, to inform, and therefore fearing its tendency to retard that long-wished-for object of NATIONAL HONOUR, the improvement of the Nautical Almanac, it becomes necessary to refute its MISTATEMENTS, and to expose its FALLACIES.

For this purpose I shall present my-readers with a copy of the Memorandum given to the Chancellor of the Exchequer; then, with the "Objections" drawn from it by the Superintendent, together with his "Answers;" and, finally, with an examination of his remarks, *seriatim*.

Thus the public will have the Memorandum and the "Answers" in their original words; and they will thence see that I have not culled from his "Answers" such passages as suit my purpose, while those are withheld from public scrutiny which militate against it.

In the Memorandum laid before the Chancellor of the Exchequer, as the means of ensuring to the Nautical Almanac that degree of standard value and universal respect which it had in former times, the establishment of a new and efficient Board of Longitude was suggested. To shew the estimation in which Foreigners viewed such an establishment, I have thought the decree by which the Board of Longitude of France was founded, would not be uninteresting; it is, therefore, placed in the Appendix. It was written at a time when the French were little disposed to imitate any thing British; yet they considered that one of the most effectual means "*pour étouffer la tyrannie Britannique,*" was to institute a Board of Longitude, avowedly in imitation of ours, to whom should be confided the publication of the *Connaissance des Temps*, and the guardianship of the public observatories. In the national cry of "*Delenda est Carthago,*" it was full well felt that the British navy was the barrier; and that in scientific navigation, not less than in nautical discipline, this obstacle between them and universal empire stood unshaken. Acting upon the old proverb, "*Fas est et ab hoste doceri,*" a Board of Longitude was instantly decreed; and the selection of its members was announced in these memorable words, "*Vos comités vous proposent des hommes que l'Europe nous envie, qui sont créanciers de la postérité.*" If ever words were verified, these were. To them the mantle of the immortal NEWTON had descended — and to them do we owe our Planetary Tables, one of the noblest achievements of human intellect.

These are subjects for serious meditation ; and therefore most earnestly do I entreat my readers to bear in mind, that the discussion to which I am about to introduce them in the following pages, is not a personal question between Dr. Young and those individuals who had presumed to address themselves to Government ; but that the real points at issue are these:—Shall our Navigators and Astronomers be supported by the national voice ? and, Shall our Country resume its former rank in that glorious field of science where it once led the Nations of Europe ?

Observatory, Kensington,
April 25, 1829.

MEMORANDUM, &c.

“THE NAUTICAL ALMANAC was always intended for the use of the astronomer as well as of the navigator. This is the declared object of the first Nautical Almanac in 1767, edited by Dr. Maskelyne, and has been the constant and uniform practice ever since.

“Soon after his decease the work got into disrepute: it was inaccurately calculated, and a number of errors were detected in several of the volumes. In the volume for 1818, *fifty-eight errors* were discovered; and Mr. Croker is represented to have mentioned this circumstance in the House of Commons (when the Bill was brought in for establishing the late Board of Longitude) as one of the arguments for placing the Nautical Almanac (the publication of which is declared by the act to be highly expedient to the interests of navigation and the *honour of the country*,) under the more immediate superintendence of that Board. It is somewhat singular that this is precisely the same number of errors that have been detected in the Nautical Almanac for the ensuing year, 1830.

“But, in addition to this circumstance, it is notorious that the Nautical Almanac has not kept pace with the improvements in astronomy and nautical science, and that it does not contain what is now requisite for the purposes either of navigation or astronomy.

“In the first place, as to Navigation: it does not contain the lunar distances from the four principal planets — Venus, Mars, Jupiter, and Saturn, which have long formed part of the Portuguese and Danish Ephemerides, and are a powerful aid towards finding the longitude at sea. It does not contain the daily positions of those planets, which (if given to the nearest second, as in the Danish Ephemeris,) would enable the navigator very fre-

quently to ascertain his time and his latitude, when other sources of information might not present themselves. It does not contain a list of occultations of the fixed stars by the moon, which were ascertained to be visible at sea as far back as the time of Halley; but which were soon afterwards neglected for the more easy, but less accurate method of lunar distances, in consequence of the invention of Hadley's Sextant. They are acknowledged (even in the Nautical Almanac itself) to afford the best means of determining the longitude. These occultations are inserted in the "Milan" Ephemeris; and it is known that, for want of this and other astronomical information, naval officers have been obliged to have recourse to foreign Ephemerides whenever they could procure them.

"Secondly, as to Astronomy: the wants are more numerous and more refined, since a much greater degree of precision is now attainable and expected in all observations than at the time of the first establishment of the Nautical Almanac. The tables of the Sun, used by the computers of the Nautical Almanac, are now ascertained to be inaccurate: corrections have been published by two distinguished mathematicians, and ought to be incorporated with those tables, in order that the improved and correct places may be given in the Nautical Almanac. The places of the four new planets ought to be given, in order to induce astronomers to look out for and observe them, and thus assist in perfecting their theory. At present those planets are not even alluded to in the Nautical Almanac, although they have been discovered these thirty years. The places, indeed, of all the planets ought to be given with the greatest minuteness for every day in the year, as in the Danish Ephemeris. The occultations of fixed stars by the moon are also as useful to the astronomer as to the navigator; and observations of them, made at an observatory, would tend to correct the result of observations made at sea (as recommended by Halley about 100 years ago), or at stations whose positions are not accurately determined. It is known that the present editor of the Nautical Almanac publishes several of these occultations in a quarterly periodical journal of considerable expense, and not always attainable by those who may require information on this subject. The distances of the planets, when they approach any of the fixed stars whose posi-

tions are known, should be given, as in most of the foreign Ephemerides, in order to induce astronomers to look out for and observe such conjunctions. The diameters of the planets should also be given at stated and regular intervals. The tables used for the reduction of the principal stars to their apparent places ought to be uniform. At present, they are taken from various authors, who assume different constants for aberration, nutation, &c. which renders the results not strictly comparable with each other.

“ Without assistance of this kind, given in minute detail and with great accuracy, the work of an observatory cannot proceed either with activity or with the most beneficial effect; and those public establishments (on which thousands are annually expended) are thus deprived of the means of exerting their whole force towards the promotion of the science for which they were specially erected and endowed.

“ A distinct account ought also to be given of every table employed in computing the several parts of the Nautical Almanac, together with an express notice of every equation omitted, or correction made in them, in order that any person may be able to verify the calculations at pleasure, or to detect any error in them. But these and other points have been so fully detailed and insisted on by one of the most distinguished members of the late Board of Longitude, in a report drawn up at their request, and read at their meeting on the 5th day of April 1827 (a copy of which is hereunto annexed), that it is needless to enlarge any further on this important subject.

“ The present expense of getting up the Nautical Almanac is represented to be an annual charge on the nation. But, by the introduction of the improvements here suggested, and a due regard to economy in other departments of the work, it might be made to repay itself from the sale of the copies, without any aid from Government.

“ In order to effect this, and to enable it to keep pace with the increasing improvements in astronomy and nautical science, a new Board of Longitude should be formed, with similar powers to the last, but wholly unconnected with any department of the state, consisting of members to be nominated by the minister, who are to act without fee or reward; and who, instead of meet-

ing only four times a year, and then only for a very short time (as was the case with the late Board), shall be considered a constant and permanent body.

“ To this Board should likewise be referred all improvements and inventions in astronomical and nautical instruments; all tables for the promotion of astronomy or navigation, as well as the reduction of useful and important observations: together with such other scientific subjects as may be considered the proper objects of inquiry and decision for such a Board.

“ That a Board of this kind is necessary and expedient appears from the fact that, since the dissolution of the late Board of Longitude, an order in council has been obtained, enabling the Admiralty to nominate and appoint, annually, three members of the council of the Royal Society (with a salary of 100*l.* a-year to each of them) to advise with the Admiralty on subjects of a scientific nature; and three of the members of the late Board of Longitude have been already nominated to that office. But this body is, from its very constitution, fleeting and dependent, as well as without power or responsibility: and it is reported, that two out of the three members so nominated have declined to act as members of a Board so constituted and appointed.

“ But a responsible, a permanent, and an independent Board would not only tend to remove those defects in the Nautical Almanac already alluded to, and cause it to rival the similar productions of other powerful and neighbouring states, and thereby add to the honour and glory of the nation, but would also be a check on that profusion and waste of public money which has been repeatedly expended on subjects hitherto unproductive of any benefit to science.

“ The truth of these statements might be more minutely inquired into, and the expediency of the measures here proposed might be rendered more apparent, by a Committee of the House of Commons appointed for that purpose, who would be the means of procuring evidence to substantiate most fully the representations here made.”

REFUTATION, &c.

OBJECTION I.—“ *The Nautical Almanac was always intended for the use of the astronomer as well as of the navigator.*”

Answer.—“ *Dr. Maskelyne's first preface declares, that the ‘Ephemeris was made to remove the difficulty and length of the calculations necessary to determine the longitude at sea.’ Any advantage that might be derived from it by astronomers on shore was certainly considered as desirable, but at the same time as subordinate to its nautical utility, the cultivation of abstract science being obviously of far less importance than the preservation of the lives and property of seafaring persons. It follows, of course, that there must always be room for discretion with respect to the degree in which subjects purely astronomical should be admitted into a Nautical Ephemeris.*”

THE first sentence, or at least words of similar import, may certainly be found in the preface to the first volume: it would, however, have been as well if the Superintendent had included in his quotation the introductory sentence; but as he has been of a different opinion, I will supply the deficiency. Dr. Maskelyne's first preface begins thus: “The Commissioners of Longitude, in pursuance of the powers vested in them by a late act of Parliament, present the public with the Nautical Almanac and Astronomical Ephemeris for the year 1767, to be continued annually; a work which must greatly contribute to the improvement of Astronomy, Geography, and Navigation. This Ephemeris contains every thing essential to general use that is to be found in any Ephemeris hitherto published, with many other useful

and interesting particulars never yet offered to the public in any work of the kind. The tables of the moon had been brought by the late Professor Mayer, of Gottingen, to a sufficient exactness to determine the longitude at sea within a degree, as appeared by the trials of several persons who made use of them. The difficulty and length of the necessary calculations seemed the only obstacles to hinder them from becoming of general use, to remove which this Ephemeris was made; the mariner being hereby relieved from the necessity of calculating the moon's place from the tables, and afterwards computing the distance to seconds by logarithms, which are the principal and only very delicate part of the calculus; so that the finding the longitude by the help of the Ephemeris, is now, in a manner, reduced to the computation of the time,—an operation equal to that of an azimuth,—and the correction of the distance on account of refraction and parallax, which is also rendered very easy by either of the two methods invented by Mr. Lyons, and published among the tables to be used with the Ephemeris." Now, if the inference drawn from the quotation, so ingeniously detached by the Superintendent from other sentences which did not suit his purpose, be correct, and that the Ephemeris was made *only* to remove the difficulty and length of the calculations necessary to determine the longitude at sea, why did Dr. Maskelyne eulogise it as a work which must greatly contribute to the improvement of Astronomy, Geography, and Navigation? Why did he, on ushering it into the world, say, that it contained "every thing essential to general use that is to be found in any Ephemeris hitherto published, with many other useful and interesting particulars never yet offered to the public in any work of this kind?" On maturely considering the sentence quoted by the Superintendent, in reference to its antecedents and also its subsequents, there can be but little doubt in concluding, that in using the words "this Ephemeris," Dr. Maskelyne alluded to this Ephemeris of the moon, or to that part of the Almanac strictly designed for nautical use: he could not mean the Ephemeris generally, as the Superintendent's convenience would fain have us believe; unless, indeed, occultations of stars by the moon, calculated to the nearest half-minute, were required; unless the sun's right ascension to seconds of time was wanted; unless the

time of the sun's semi-diameter passing the meridian was needed; unless the eclipses of Jupiter's satellites were needed; unless the places of Mercury, of Venus, of Mars, of Jupiter, and Saturn, were wanted for the determination of the longitude at sea by the observed distances of the moon from the stars: whether the information thus alluded to, and which is contained in the very first volume of the Almanac, be really required, in order to ascertain the distance of the moon from a star, I leave the Superintendent to determine. The remainder of the sentence is intended as an elucidation of the correctness of the former. Let me, however, remind the Superintendent's readers, that to "the cultivation of abstract science" (for to astronomy he must allude, if he allude to any thing) are these seafaring persons indebted for whatever means they at present possess of preserving their property and lives. This extreme sensibility for the lives and property of seamen comes with peculiar ill grace from one who has, for the last seven years, withheld from these very seamen those powerful aids to the safety of their ships and persons; namely, the lunar distances of the planets and the planetary Ephemerides.

As for what ought to be, and what ought not to be, admitted into the Nautical Almanac and Astronomical Ephemeris, there will "always be room for discretion." Those, however, who are called upon to exercise it, should possess it; and all my respect for the Superintendent's talents (and it is not little) does not preclude me from believing, that he neither is a judge of the wants of the astronomer, nor of those of the navigator. Place him in an observatory, he would be as much at a loss to direct an instrument to a star, as he would be to navigate a vessel from his own observations. Dr. Maskelyne could do both. In adverting to the Nautical Almanac, I have joined to it its other title, namely, Astronomical Ephemeris; whilst the Superintendent alludes to a Nautical Almanac, in contradistinction to an Astronomical Ephemeris. As yet, however, such a work is, and I hope ever will be, unknown in this country. What Dr. Maskelyne has joined, let not Dr. Thomas Young put asunder.

OBJECTION II.—“ *The Nautical Almanac of 1818 had fifty-eight errors ; that of 1830 has also fifty-eight.*”

Answer.—“ *The number of fifty-eight errors in 1830 is every way exaggerated ; but it is only necessary to observe, that forty-eight of them are properly but ONE, and that the sheets principally affected by these were CANCELLED before one-fiftieth part of the impression was sold ; so that the circumstance, instead of being made a matter of accusation of the present arrangement, ought to be considered as affording an ample proof of its accuracy and sufficiency. Computers are but men ; and a computer had put a 4 for a 3 in one of the moon’s radical places. The comparer had applied the proper mode of detection without success, from a singularity in the successive orders of differences. The mistake was discovered by the minute comparison with the *Connaissance des Temps*, which has been annually made by the Superintendent, or by an assistant. An error of five miles in a ship’s place for a single day was the greatest possible inconvenience that could have happened ; but no time was lost in cancelling the pages, though, in this and other similar cases, it was absolutely impossible to recall the copies that had been distributed, and it was necessary to notice the errors briefly in the volume of the next year, which every accurate navigator is bound to consult, if he wishes to be guarded against the possible consequences of such minute accident. The other errors of 1830 are of still less importance.*”

I have referred to the Almanac for 1830, and contend that the statement made to the Chancellor of the Exchequer is correct. The Superintendent says, “ it is only necessary to observe that 48 of them are properly but *one* :” now, what he thinks “ only necessary to observe,” is one thing ; but what he can prevail upon us to believe, is another thing. His new arithmetic is past my comprehension. But the sheets principally affected by these errors were cancelled before one fiftieth part of the impression, namely, 140 copies, were sold : this very circumstance acknowledges the

dereliction of care; and gives us strong grounds for supposing that, at that time at least, the Superintendent's mathematics had not led him to the sublime discovery that 48 and 1 were equivalent quantities; or, why cancel sheets for one error? What must be right in one instance cannot be wrong in another; and if a single error is to authorise the cancelling of a single sheet, not to say any thing of sheets, the Almanac, upon the Superintendent's own shewing, would be without one. But 140 only of these 58-errored gentry were sold; this is no palliation, since it is more than probable (seeing that the Nautical Almanac last published is generally the last thing sought after by a seaman before he quits London for his ship) that the greater part of these 140 recreants were purchased by seamen; are these men to have the gift of prophecy to tell them what pages were inaccurate, and what were accurate? and will those who thus carelessly propagate error, and as shamelessly palliate it, be bold enough to say, that, if such conduct be countenanced, many a ship will not be lost? Away, then, with such flimsy excuses for errors abounding in a book, which, in the appropriate words of Mr. Croker, "*ought to be especially, and above all other productions, void of error.*" That the 58 errors, therefore, which I assert do exist in the Almanac for 1830, ought to be considered as affording "an ample proof of its accuracy and sufficiency," I am ready to allow; for they assure me that it has no claims to the one, and no pretensions to the other.

The Superintendent coolly adds, that "it was necessary to notice the errors briefly in the volume of the next year, which every accurate navigator is bound to consult, if he wishes to be guarded against the possible consequences of such minute accident." Now, this is all very pretty, and may do well enough for the astronomer at home; but how is this navigator, who quits England before this next volume, this panacea for the Superintendent's carelessness, is published, and who has frequently no means of procuring this new light till after the want of it may have been severely felt—how is he, I ask, to get the new volume, this corrective of preceding delinquents? The evasion is as paltry as the scheme is impracticable. Again I tell the Superintendent, that each volume of the Almanac should contain a list of its *own* errata; his duty requires it of him, and humanity demands it.

We are next told,—

“ A few years ago, Professor Schumacher, of Altona, had all the moon’s places computed before he received the Nautical Almanac for the year; and the greatest error that he discovered was one of four seconds of space, answering to two miles of longitude, in the result of an observation.”

Now, neither the memorialists nor the objectors have said any thing about the lunar places. Charges enough, in plain, intelligible language, have been brought against the Almanac—why does not the Superintendent answer them? One of those disproved, will do more good to his cause than volumes of irrelevant matter.

“ In the Connaissance des Temps for 1822, we find a list of more than seventy-three errata for the preceding volume, with this acknowledgment:—

“ ‘ M. Thomas Young, qui a été chargé récemment par le Bureau des Longitudes d’Angleterre de la publication du Nautical Almanac, a eu la bonté de nous fournir les élémens de ces errata. Les fautes, qu’on y remarque, ont été découvertes en comparant, nombre à nombre, ce volume de la Connaissance des Temps avec les Ephémérides Anglaises. Quelque considérable que ces errata puisse paraître, on n’aurait le droit d’en conclure que le volume de la Connaissance des Temps de 1821 est inférieur en exactitude à d’autres Ephémérides, ou aux anciens volumes du même ouvrage, qu’en soumettant ces derniers à un examen également minutieux. La Connaissance des Temps acquerra désormais plus de précision.’

“ To the same test, of which the severity is here very properly appreciated, the Nautical Almanac and the Connaissance des Temps have been constantly submitted for the last ten years; and the errata discovered by it in the French work have been regularly above forty; those in the English always under twenty; and many of these unimportant and perfectly venial.

“ *A similar acknowledgment is found in the Connaissance des Temps for 1828, after a table of about fifty corrections for 1827 :—*

“ ‘ *Ces errata ont été redigés, en très grande partie, ainsi que ceux de plusieurs années précédentes, au moyen du tableau des erreurs que M. le Dr. Young a eu la bonté d’envoyer à M. Arago, et qui ont été trouvés par une comparaison faite avec beaucoup de soin entre la Connaissance des Temps et le Nautical Almanac.*’

“ *In the English work for the same year there are twelve errata ; and seven of these, small as they are, depend on an error in Taylor’s Logarithms, not before discovered.*”

The errors in the French Nautical Almanac are no palliatives for errors in the English one ; the latter is for our use, the former is for that of the French. If the French nation be satisfied with their own, be its inaccuracies many or few, we have nothing to do with them. How far the accuracy of the one exceeds at present the accuracy of the other, the limits of this paper will not allow me to inquire ; suffice it to say, when I last compared their calculations and those of the English Nautical Almanac with my own observations, the French work far surpassed the English in accuracy. There is, moreover, one thing which ought not to be omitted ; the British nation gave almost an unlimited power to the late Board of Longitude ; no expense was grudged by the Legislature ; duplicate, nay triplicate computers, were, I believe, within their reach. In France it is otherwise ; one set of computers is alone allowed, and their results are verified by the individual members of the Board of Longitude ; I have seen these illustrious men at work, and have, in more than one instance, helped in comparing the results. The phenomena of occultations of stars by the moon, and of the conjunctions of the stars and planets with the moon, are computed by one of the Board, who does it for amusement, and for the gratification of being useful.

As to this invidious comparison of the two Almanacs, I think it will strike every reader, that the paid Superintendent of the one would have been more pertinently and more creditably

employed in examining the work of his own computers, and correcting their errors, than in detecting the oversights in the other, and triumphing over its alleged inferiority. To the *Connaissance des Temps* for 1827 he assigns 50 errors, and to the *Nautical Almanac* 12; but I contend that the latter has an indisputable claim to 101, and that its editor is fairly open to the reproach of neglecting the beam in his own eye, while he is sneering at the moat in another's.

“ *A still more flattering testimony of personal approbation was received by the Superintendent, from Paris, in 1827, when he had the honour of being made one of the eight Foreign Associates of the Academy of Sciences, and the only English mathematician on the list. This distinguished compliment he attributes in a very considerable degree to the assistance which he had been enabled to give to the Bureau des Longitudes in the final correction of their National Almanac, though he would have been ashamed to appeal to it on such an occasion as the present, except as an authority sufficient to compensate for the unexplained displeasure of some of his own countrymen.*”

Here we are informed what it was that led to the Superintendent's election to the title of Foreign Associate of the Académie des Sciences, namely, that he attributes the “distinguished compliment in a very considerable degree to the assistance which he had been enabled to give to the Bureau des Longitudes, in the final correction of their National Almanac.” Till now I had, in common with many others, felt a little surprise at that election, seeing that such a man as *OLBERS*, the discoverer of the planets *Pallas* and *Vesta*, was, on that occasion, passed by: were this, however, a correct version of the affair, it would reflect but little credit on either the elected or the electors. Was there no kind friend to whisper to the Superintendent, “*Vide quæso etiam atque etiam, ne illarum quoque rerum pulcherrimarum à te ipso minuatur auctoritas?*”

To have been the free choice of the Académie des Sciences would, indeed, be a proud distinction; but to have been selected

from a kind of complaisance from that learned body to the Bureau des Longitudes, might, to a person of delicate feelings, be thought rather humiliating.

That he is the “only English mathematician on the list” is true; if, however, he mean it to be understood that he was placed there as the English mathematician *par excellence*, I beg to undeceive him: the relative merits of English mathematicians are better appreciated by the French geometers: and I can tell him that it was “*ni comme astronome, ni comme physicien, ni comme géomètre, mais seulement comme savant distingué*,” that he was appointed. But the Superintendent, fearing lest any one should deem this testimony far-fetched, and feeling when minutely examined that it will carry but little weight, tells us “he would have been ashamed to appeal to it on such an occasion as the present, except as an authority sufficient to compensate for the unexplained displeasure of some of his own countrymen.” Now, as to what he would or should have been ashamed of, it is no business of mine to inquire further; but if he mean to class me as one among the “some of his own countrymen whose displeasure is unexplained,” I am indeed surprised. If he allude to a former work of mine in 1822, he will find it difficult to prove any displeasure towards him stated there; and if to a late pamphlet, he must remember that my “Reply” was forced upon me by others; might I not add, partly by one or other of his own friends resident at Edinburgh; and if in that pamphlet the cause of my “displeasure” is unexplained, it must have been written to little purpose. I think I may challenge him to bring forward thirty-eight octavo pages, which admit less ambiguity of interpretation. I am, however, happy in having an opportunity of reiterating that I have no personal feelings towards him but those of kindness, and that by no one are his varied talents held in higher estimation; but that, viewing him as the responsible officer in a department of great scientific interest and of great national importance, I have openly, and do frankly charge him with stubborn and mischievous resistance to the numerous demands of our astronomers, and to the obvious wants of our seamen.

“*In the Connaissance des Temps for 1831, the phenomena of Jupiter’s satellites are rather more correct than in*

the Nautical Almanac, from the sudden adoption of some improvements in the tables, suggested, as the Baron de Damoiseau will readily admit, in this country, after the computation of the English work was completed, and before the appearance of the French; the English editor particularly desiring to wait for the approbation of the French before he admitted the corrections into the Almanac, having always earnestly wished that the two Almanacs should go hand in hand, adopting or resisting in common whatever improvements or innovations might be suggested, and having been convinced by experience of the utility of such a concert and correspondence in facilitating the annual comparison so beneficial to both."

Here we have, indeed, a voluntary acknowledgment of inferiority on the part of the Nautical Almanac; but for what purpose?—why to give us an opportunity of learning that some improvements of the tables which have been adopted in the French work, were suggested in this country: now, from the context, as well as from the absence of any other name, it is natural to infer that the suggestions came from the Superintendent; if, however, report speak truth, it would not have been extremely unjust to have said what part of the suggestions originated with him, and what part with Mr. Jenkins, lest the entire merit should by accident be adjudged to the Superintendent: and if it be correct that the said Mr. Jenkins has in former instances also rendered similar services to the Superintendent, I would suggest that the latter accept the Chiltern Hundreds, and that he and Mr. Jenkins, each of them being *adjoints du Bureau des Longitudes de France*, go to the election together; and if Mr. Jenkins have his merits, the Superintendent's re-election will be doubtful.

Why the Superintendent was particularly desirous of waiting for "the approbation of the French before he admitted those corrections into the Nautical Almanac," or why he so "earnestly wishes that the two Almanacs should go hand in hand, adopting or resisting in common whatever improvements or innovations might be suggested," is quite incomprehensible, notwithstanding

his conviction "of the utility of such a concert and correspondence in facilitating the annual comparison so beneficial to both." Not content with having borrowed from our French friends their astronomical tables, must we also go abroad to have our numerical results verified? If we have not mathematical talent to construct astronomical tables, can we not compute from them when made for us by others? But Maskelyne would have been ashamed to make such an avowal. There are many volumes of the *Connaissance des Temps*, which, during the revolutionary years, Maskelyne never saw; are the corresponding volumes of his *Nautical Almanac* less accurate on that account? No. Are they less accurate than those of the present Superintendent's, even after the latter have undergone their final French ordeal? No. Hence it follows, if the *Almanac* were computed as it ought to be, and as the almost unlimited liberality of the Government has a right to expect and to enforce, nothing short of improved tables, or more perfect formulæ, should justify the alteration of a single figure of its contents, after it has been presented to the public. Were I called upon to state why that is now found necessary to be done, which was unnecessary during Maskelyne's superintendence of the *Almanac*, which by the by was gratuitous, I should not hesitate to impute it to the multifarious stipendiary characters which distinguish the present Superintendent from Dr. Maskelyne. The Superintendent is a Physician in private practice—a Physician to a public hospital—a perpetual Secretary to the Royal Society—an Actuary to a Fire and Life Insurance Office—and a quarterly Contributor to Mr. Brande's *Journal*. Now Maskelyne was an Astronomer.

"With respect to the German Almanacs, the superiority of which had been asserted in a paper published some years ago by Mr. Baily, Professor Schumacher took occasion, in the sixth number of his Astronomical newspaper, to express his formal dissent from Mr. Baily's decision; but the candid opinion of an impartial foreigner appears to have had no weight with the antagonists of the Nautical Almanac."

Now, as I am doubtless included in this honourable list, I beg to say, that for Professor Schumacher I have the greatest possible respect; and most ardently do I wish that he could infuse into the Superintendent of our Nautical Almanac a fractional part only of his astronomical zeal; but before his candour had been invoked, and his opinions held up for our imitation, it would have been "candid" to have given them in his own words, which in point of fact bear no such general construction. With this part of the subject, however, I forbear to meddle; Mr. Baily is perfectly competent to sustain his own positions.

OBJECTION III.—“*The distances of the moon from the planets ought to be inserted, as well as their daily places.*”

Answer.—“*It happens but rarely that the planets are visible for any length of time without the stars; and the places of the stars must always be known with somewhat greater precision than those of the planets. But the Board of Longitude had for many years annually imported, and had endeavoured to introduce into the naval service, the excellent planetary tables published under the direction of Professor Schumacher; and they never refused any offer of a gratuitous communication of any part of this work, though the public shewed little inclination to benefit by the tables; the sale in London having scarcely amounted to one-hundredth part of that of the Almanac; so that to have added so much bulk to the whole impression would have been prodigality, either of public or of private expense. There is, however, reason to hope that the separate sale of the planetary distances in this country will be considerably increased hereafter.*”

Even the Superintendent's ingenuity is at a loss to excuse the omission of these distances which have been so long claimed at his hands, and he is obliged to have recourse to the most paltry sophistry. The question is not whether the places of the planets are or are not known with *equal* precision to those of the stars,

but whether they are known with sufficient precision to give their distances from the moon, for nautical purposes. Lest my evidence on this subject might be deemed partial, let us refer to Mr. Herschel's Paper, where, after alluding to the absence from the Almanac of all information relative to the four new planets, he says, "The declinations and right ascensions of the other planets (viz. Mercury, Venus, Mars, Jupiter, Saturn, and the Georgium Sidus), too, are not given with sufficient accuracy or frequency. Their theory is now so perfect, that they may be rendered available for every purpose of practical astronomy; and the want of their places to seconds and decimals of time, and seconds of space, with their semi-diameters, and parallaxes, and daily motions, is a desideratum which ought to remain no longer such." (Vide Herschel's Paper, p. 5.) Indeed, the latter part of the Superintendent's paragraph shews that, notwithstanding the insinuation as to the inaccuracy of the tabulated places of the planets, they are sufficiently accurate for the purposes of navigation; otherwise, why does he inform us that the "Board of Longitude had for many years annually imported, and had endeavoured to introduce into the naval service, the excellent planetary tables published under the direction of Professor Schumacher?" And why else does my dexterous opponent tell us there is "reason to hope that the separate sale of the planetary distances in this country will be considerably increased hereafter?" But, as if the Superintendent felt that some clashing sentiments might be elicited from the examination of his various publications, we have another reason advanced to justify the omission, namely, the "little inclination which the public shewed to benefit by the tables;" and, as proof of this, we are informed, "that their sale in London scarcely amounted to one-hundredth part of that of the Almanac; so that to have added so much bulk to the whole impression would have been prodigality, either of public or of private expense." Here we have economy brought in as the subterfuge; whilst in another place it is officially announced, "that any advantage to be gained from the insertion of the moon's distance from Jupiter must depend on the precision of the tables of that planet, a point which is expected to be very shortly determined from the most accurate observations:" and this reason is not

advanced on the spur of the moment ; for it will be found deliberately repeated year after year in the preface to those unerring guides, those monuments of editorial precision, the Nautical Almanacs from 1822 to 1828. It is true, the Almanac for the present year is deprived of this precious paragraph, not because the point seems to have been yet absolutely determined, for the Supplement of the present year—a production of which I shall have occasion probably to speak hereafter—gives us to understand that certain gimcracks were inserted, because they are data which the “ navigator may have occasion to employ in the determination of his longitude by the observed distances of the planets from the moon, should that method be found sufficiently exact to be relied upon.” Is there any cause for *hope*, then, that the sale of tables, having for their object the promulgation of methods not yet (December last) “ found sufficiently exact to be relied upon, will be considerably increased hereafter?” But we are told in another part of this amusing paragraph, that “ it happens but rarely that the planets are visible for any length of time without the stars :” thus, then, it seems that one part of this paragraph extols the employment of these “ excellent planetary tables,” whilst another part endeavours to decry their use. If these *neutralising* statements were deserving of serious consideration, I would ask who it was that informed my mathematico-astronomical opponent that “ it happens but rarely that the planets are visible for any length of time without the stars?” Does he not know that the planets here alluded to, viz. Venus, Mars, Jupiter, and Saturn, are visible during morning and evening twilight? Does he not know that Venus is for many weeks together as visible to the unassisted eye during the day as is the brightest star with the aid of powerful telescopes? Need I inform him, also, that, independently of these circumstances, the wandering position of the planets affords great facilities to seamen in determining their longitudes? The position of any of the visible nine principal stars relative to the moon may be inconvenient for easy observations of distance, whilst those of the planets, or that of one of them, may be as commodious. Again, clouds may be in that part of the heavens where the moon’s distantial stars may be placed, whilst the portion of the sky where the planet may be situated will be cloudless. Again, haze may render a star in-

visible, or too indistinct for observation, whilst the planet's splendour shines through it. Or, need I tell him, that the brighter is the object to be brought by practical dexterity apparently to the moon's limb, the more easily will the contact be brought about? Let the detractor from the planets' superiorities look out of his study window on a fine night, and he will have some difficulty instantaneously to detect the first and last stars of the canonical nine, namely, α Arietis and α Pegasi: should, however, Venus, Mars, Jupiter, or Saturn, be above the horizon, I have much doubt if even he could mistake one of them for a fixed star. But it is not only in the determination of longitude that these planets are wanted; the latitude of the ship by their aid may likewise be acquired with every necessary accuracy; in short, these planets may be considered as nocturnal suns, and should be observed with the utmost avidity and care. But it seems the "Board of Longitude had endeavoured to introduce into the naval service these excellent planetary tables." How? What were the means the Board adopted? I have looked over the various prefaces of the Nautical Almanac from 1822 to the present year, and I can find no recommendation that seamen should use them; indeed, very little is said about them; that little has been inserted in the discussion of this paragraph, and how far it savours of persuasion to seamen to employ them, I leave the public to judge. I have dwelt on this subject long, but it is an important one; and I hope the time is not far distant, when, in spite of the Superintendent's intentions, hopes, and acts, our seamen will not be compelled either to go to sea without these "excellent tables," or to give to the bookseller their hard-earned money for what should be found in the Nautical Almanac.

OBJECTION IV.—"*It does not contain a list of occultations.*"

Answer.—"*It contains a list of all possible occultations of stars not less than of the fourth magnitude, and in the best possible form for the computation of observations in distant parts of the world. The list must be at least five times as long, and must occupy thirty or forty pages, if it were extended to all the stars of the sixth magnitude.*"

This is not a mere discordance of speculative opinions. We are at issue on a direct point of fact. He says that the Almanac contains a list of all possible occultations of stars not less than of the fourth magnitude. I say that it does not contain one; and the only evidence which I shall adduce is the title of the tables to which he alludes, viz. “Elements for Computing the principal Lunar Occultations.” Is there not an essential difference between the computed time of an immersion and the data for computing it? Would the moon’s latitude and longitude, along with a formula for computing the lunar distances, be considered as tantamount to those distances ready calculated and tabulated for the convenience of seamen? Or would he presume to say, that a table containing such means of computing the distances was the “best possible form” in which they could be given? A Nautical Almanac and Astronomical Ephemeris is wanted, not only for the computation of observations, but for rendering computations of phenomena, which may or may not happen, altogether unnecessary.

Would I could impute the concluding sentence of this paragraph to ignorance also, but I cannot. The Superintendent says, “the list must be at least five times as long, and must occupy thirty or forty pages, if it were extended to all the stars of the sixth magnitude.” This is, indeed, an assertion of an appalling nature. Does he think there is a man in the country, at all conversant with practical astronomy, weak enough to give credence to the assertion? Nay, does he even believe its veracity himself? if he do, I will herewith undeceive him; and doubtless in his next “answers” he will thank me for the instruction. The moon is of a determinate magnitude; she passes round the earth about an equal number of times in any given number of years: hence, therefore, if we have a list of occultations calculated for one year, we shall not much err in considering it a fair specimen of the number of stars of which she will produce to us occultations in other years. Fortunately, the noble Ephemeris of Encke for next year is before me; and by reference to it, I find that the number of occultations of stars by the moon, calculated for Berlin, including all stars of the seventh magnitude, amount to about 133, and are contained in less than four widely printed pages of *his* Ephemeris; whilst those of the

seventh magnitude being deducted, the number (including all those whose magnitudes are doubtful, whether of the sixth or seventh) is about 95; and so far from thirty or forty pages being wanted, two pages, nay, less than two pages of the Nautical Almanac would afford ample room to contain them. But some will exclaim, seeing that the Superintendent's assertion and mine are so widely different, that by some strange direction of the moon's path, the next year may be peculiarly sterile in regard to occultations; I will, therefore, appeal to another year, 1822, a year when the moon passed over the Pleiades several lunations: thanks to the Milan Ephemeris, the list of occultations calculated for the meridian and parallel of Florence is before me; and I find that precisely the same number of occultations, including those of stars of the sixth, and of the sixth or seventh dubious magnitudes, is presented, namely, 95. Here, then, again we are at issue on a plain matter of fact. I say that two pages would afford ample space for all the occultations I want: he says they would occupy thirty or forty: let the world judge of his assertions and his arguments by this sample. The paragraph was written *ad captandum vulgus*, little thinking it would be employed *ad captandum seipsum*.

“ *The Astronomical Society has lately induced Mr. Henderson and another gentleman to compute the visible phenomena of the occultations of Aldebaran for the current year: they have very properly extended the calculation of each to ten places of observation in different parts of Europe; and if occultations were computed in this manner for the use of nautical persons, it would require 100 or 1000 computations for each occultation, while the elements published in the Nautical Almanac are equally applicable to all places. It accidentally happened that Captain Smyth had occasion to observe some occultations on the coast of Italy, and he was naturally much assisted by an Ephemeris, calculated by Inghirami, for a neighbouring meridian, which of course had, in this case, an advantage over every other Almanac; but to say that he therefore preferred the foreign Ephemeris to the Nautical Almanac is a gross misrepresentation of the fact.*”

Now, why the public are to be informed what the Astronomical Society have done or have not done, I am at a loss to conceive : the diligent Superintendent of the Almanac is no member of that respectable Society, and as he does not seem to know why the calculations of the approaching occultations of Aldebaran have been, by their directions, extended to ten places of observation, charity induces me to inform him. Occultations of stars by the moon, from the time of Père Feuillée, in 1699, to the present time, have been occasionally seen to present the phenomenon of apparent projection of the star upon the moon's face, preceding immersion behind, or emersion from the limb ; in short, giving an appearance as if the star were between the observer and the moon ; but of all the stars in the heavens, Aldebaran has furnished the most frequent, as well as the most remarkable instances of it. The Society, aware that the cause of the phenomenon was no more understood now than it was 130 years ago, was anxious to call the particular attention of astronomers to the ensuing occultations, with a view to its probable explanation. The Society knew full well that towards such observations being accurately made, no one thing was so essential as to place in the hands of astronomers of repute calculations of the times at their Observatories of the stars' immersion and emersion, accurate to a minute or two : and that those who were paid for computing,—I beg pardon, for publishing—computed occultations, had, in spite of the repeated requests of many of their own members, and of the assurance of the Astronomer Royal that they *should* be given in the Nautical Almanac, were *not* given, even for the meridian of Greenwich. Thus much for the reasons why “ Mr. Henderson and another gentleman” (Mr. Maclear of Biggleswade), were induced to do that which they have done. But because these occultations of this particular star were, for a specific purpose, computed for ten different places, is it to be insinuated that the advocates of Nautical Almanac reform, or innovation if the Superintendent please, wish for the calculations of every star to be thus extended ? No such thing ; and to prevent the propagation of so monstrous an absurdity, I herewith tell him, that all we want by way of calculated occultations, and also what we will not be content till we get (though, perhaps, not from him), is, the times of immersion and emersion of all stars down to the 6th magnitude

inclusive, computed for the meridian of Greenwich. What the astronomers of Milan, of Berlin, of Bologna, and of Coimbra have, surely the astronomers of Great Britain ought not to be denied. The astronomical character of the country ought no longer to be compromised out of misplaced deference to individual obstinacy.

Having dwelt thus long upon sidereal occultations, perhaps it will not be inappropriate to say a few words about planetary occultations. These are a class of observations which are indeed interesting, and, as such, are entered in the Nautical Almanac; the times of immersion and emersion being given as in the good old-fashioned days of Dr. Maskelyne. Now, these being phenomena which an astronomer can scarcely expect to see more than once in his life, it follows that every possible accuracy should be resorted to in the prediction of them. What, then, are we to think of the information given to us by the Superintendent in the Almanac of 1826, where the moon is noted, on the 16th of February, at four o'clock, to be in conjunction with the planet Saturn, the following assertion being affixed to it, "a near app."; "app." being an abbreviation of the word appulse; implying, therefore, that the limbs of the moon and of Saturn would not come in contact; yet, so far from this proving true, the planet Saturn was seen to be eclipsed by the moon, by the Astronomer Royal, at Greenwich Observatory, and by Captain Beaufort and myself, at my observatory in Sloane Street, about three quarters of an hour!!

Again, on the 14th of October, 1830, the planet Venus is said by the Superintendent to be in conjunction with the moon; and to this information is added, "a near appr."—the latter letters meaning the word "approach." Of what nature, however, is the Superintendent's "near approach?" why, a complete occultation. My attention to this subject was accidentally drawn whilst counting, in Encke's Ephemeris, the number of stars which, during next year, will be occulted by the moon. On superficial examination, the occultation of Venus seemed so considerable at Berlin by Encke's calculations, that it seemed difficult to imagine how an occultation to a considerable extent could be eluded here. I mentioned my suspicions to Mr. Henderson; he kindly promised me to undertake

the computations; and from them it follows that the planet will disappear behind the moon a minute or two before she rises, and that she will emerge at about half an hour past five in the morning, having been eclipsed by the moon more than three-quarters of an hour!! But what blunders are too scandalous to obtain admission into the pages of the Nautical Almanack? A two-penny half-penny Almanac, published by one of the semi-starved assistants of the Royal Observatory at Greenwich, corrected the blunders of the Superintendent relative to his near appulse of Saturn in 1826; and, I doubt not, Moore's, or the old woman's Almanac, will do the same for the near approach to the moon which the English Mathematical Association of the Académie des Sciences has prepared for Venus during the ensuing year.

From the manner in which I have enlarged upon this topic of occultations, some may suppose it is to me a favourite department of practical astronomy, and that some reasons of a personal nature have stimulated me to be thus earnest in my appeal. Should any such there be, let me assure them the case is otherwise; and if there be one individual in the country to whom calculated occultations are less necessary than to another, thanks to my five-foot equatorial, that individual is probably myself. By its aid a few minutes are alone necessary to tell me what stars will probably be eclipsed during the night; and from the unerring certainty with which the instrument may be directed to the precise point which the star occupies in the heavens, the time of its re-appearance from behind the moon's limb may be readily enough determined; the perfection and optical power of its telescope being equivalent to its mechanical attributes. In short, instrumental manipulation does for me what tedious calculation does for others. Astronomical information, however, by the establishment of the Nautical Almanac, was intended for all, and ought, therefore, to be accessible to all. The humblest individual has it in his power to increase, by his observations, the utility of the most splendid observatory upon earth. A visit to an astronomical amateur at Kew led to the discovery of aberration and nutation by an amateur observer:—a simple Newtonian telescope, of seven feet focus, and six inches aperture, in the hands of another, extended the preconceived boundaries

of our planetary system, and shewed to us the Georgium Sidus, which, though seen almost a hundred years before at Greenwich, and subsequently at Paris and Gottingen observatories, yet escaped detection as a planet by Flamstead, by Bradley, by Lemonnier, and by Mayer. Again; the planets Pallas and Vesta, which evaded the observations at all the national observatories of Europe, were discovered by another amateur, whose observatory was a bed-room, and whose instrument of observation was a petty achromatic.

We are next told, “it accidentally happened that Captain Smyth had occasion to observe some occultations on the coast of Italy,” &c. Now, how a person employed by the British government to survey a very considerable extent of coast for the hydrographic benefit of his country, *accidentally* happened to have “occasion to observe some occultations on the coast,” where duty and consequently design led him, I presume not to understand; although I can perfectly comprehend how an Ephemeris of foreign construction supplied the deficiencies of the Nautical Almanac. The last sentence, however, of this paragraph is of a curious construction, and as the last few words of it have rather an awkward appearance, I shall requote it, and subjoin the passage from the Memorial, of which it would seem to be a transcript. The Superintendent’s words are: “But to say that he, (Captain Smyth) therefore, preferred the foreign Ephemeris to the Nautical Almanac, is a gross misrepresentation of the fact.” The memorialists say: “These occultations are inserted in the Milan Ephemeris; and it is well known, that for want of this and other astronomical information, naval officers have been obliged to have recourse to foreign Ephemerides, whenever they could procure them.” Mr. Baily, in alluding to the scientific officers of the British navy, says: “Many of those *I know* lament the present defective state of the Nautical Almanac, and the necessity of referring to *foreign* Ephemerides for what should be contained in our own;” to which is added the following as a note: “Witness the remarkable fact mentioned by Mr. South, that Captain Smyth (whilst employed by the Admiralty in surveying the coasts in the Mediterranean) was obliged to refer to foreign Ephemerides for information which was not to be found in the Nautical Almanac.” Vide “Further Remarks on the present defective

State of the Nautical Almanac," pages 7 and 8. In my "Reply to a letter in the Morning Chronicle," to which Mr. Baily alludes, will be found: "Such is the state of the British Nautical Almanac and Astronomical Ephemeris at the present moment: it neither supplies the wants of the seaman nor those of the astronomer: it is a miserable production." To this paragraph the following is a note: "As an instance of this, I will mention the fact, that Captain Smyth, while employed in his survey of the Mediterranean, at the expense of the British Government, discarded the British Nautical Almanac altogether, and applied to foreign Ephemerides for all his wants!!!" The words, therefore, used by the Superintendent are not literally those of the memorialists, of Mr. Baily, or myself. But Captain Smyth shall speak for himself, as I have just received a letter from him on the subject of this "gross misrepresentation of the fact;" and the extracts in the note will enable my readers to judge for themselves.* The fact is, that, far from exaggerating the circumstance, I left the captain's narrative unfinished,—or I might have said, in elucidation of that distinguished hydrographer's value for the British Nautical Almanac, that, falling in with a Spanish frigate, mutual interchanges of civilities took

"Crescent, Bedford, April 15, 1829.

* "I received your note this morning acquainting me with the strong expression advanced by Dr. Young, — that the mention of my having had recourse to foreign Ephemerides in preference to the Nautical Almanac, was "*a gross misrepresentation of the fact.*"

"I cannot but regret that a person whose extensive talents I so highly respect and admire, should have risked so unauthorised an assertion; for it would have given me much pleasure, had it been communicated to me before it was committed to the printer of the House of Commons, to have corrected the mistake. I certainly had recourse to the Almanacs of Paris, Milan, Bologna, and Florence, not only for the facilities which they afforded me, but also from a conviction of the omissions and numerous errors of our national work,—errors which even pervaded the useful series of lunar distances, so material to seamen.

"It must be recollected, that mine was not an *accidental* occasion, as implied; it was an extensive and detailed survey of the Mediterranean shores, in which was involved the determination as to latitude and longitude of nearly two thousand geographical points,—a survey to which the combined English, French, and Russian fleets, are now implicitly committing their safety.

"W. H. SMYTH."

place, and knowing how much the Nautical Almanac in former and in better times was prized by foreign seamen, he gave the Spanish captain all the volumes of the current and subsequent years which he possessed : *Proh Deûm atque Hominum fidem ! quid est, si non hæc contumelia est ?* Fortunately for the benefit of hydrography, Captain Smyth with his foreign Ephemerides found his way to England ; but, there is an awkward story afloat, that the Spanish captain has not since been heard of.

“ *The objectors to the late omission of the phenomena of occultations for Greenwich, appear not to have been aware, that the greater part of them were omitted many years ago, by the express direction of Dr. Maskelyne. But, as an undeniable proof of the comparative inutility of these pre-computed phenomena, it is sufficient to observe, that they were inserted in the Nautical Almanac from 1816 to 1821, as deduced from the places of nine stars of the first and second magnitude, sent by Dr. Maskelyne to the computers in 1810, four of which, from some unaccountable accident, were erroneous to the extent of seven minutes ; and yet the mistake was never discovered by practical astronomers till it was corrected by the present Superintendent. At Berlin, where the principal occultations have always been very accurately predicted, it has happened to the great observer Bode to be a whole year without being able to see one of them ; and lately, at Cambridge, Professor Airy could only observe one in more than a year, and for this he found no corresponding observation elsewhere. But, whatever may have been said in the times of Halley or of Ptolemy, corresponding observations, in the present state of the lunar tables, are perfectly superfluous for the purposes of Nautical Astronomy.*”

Now, as to what calculations of occultations were omitted many years ago by Dr. Maskelyne, I cannot be supposed to know ; but I do know that in the preface to the Nautical Almanac for 1820 stand these words, dated Greenwich, January 1, 1817, and signed J. Pond, Astronomer Royal : “ It

was about this time (viz. the death of the Rev. Mr. Hutchins) probably that he (Dr. Maskelyne) gave directions for omitting the occultations of all the stars, excepting some of the first and second magnitudes; this was done partly to alleviate the labours of the computers, which had been much increased by the introduction of the new lunar tables, and partly, no doubt, from the conviction of the little importance of these occultations. But as cases may possibly, though rarely, occur in which corresponding observations may be made of these small stars, the commissioners have given directions that in future these occultations shall be inserted as formerly." I leave the Superintendent all the benefit he can derive from his reference to Dr. Maskelyne, only observing, that the directions given on the Astronomer Royal's authority by the commissioners have not yet been attended to. As to the mistake in the places of four of these stars, which was not discovered by practical astronomers till it was corrected by him, and upon which he, the Superintendent, exults not a little, let us see what Mr. Pond says on the matter. The paragraph succeeding that just quoted stands thus: "As it sometimes happened that a whole year elapsed without any occultation taking place of those stars selected by Dr. Maskelyne for computation, it was very naturally suggested that the omission arose from neglect." In the Superintendent's rejoinder, which, doubtless, will enlighten us upon many subjects, perhaps he will give us the names of those wrongly tabulated stars, and say also how many times each of them was occulted by the moon during the five years to which he alludes?

But "at Berlin, where the principal occultations have always been very accurately predicted, it has happened to the great observer, Bode, to be a whole year without being able to see one of them." What this is intended to prove, I know not, unless to convince us that there were clouds at Berlin, as well as in other places. Till informed of it by the Superintendent, I was not aware of the observations of the "great observer Bode." Where has the Superintendent fallen in with them? I confess I know not where to look for them. Perhaps, however, the Superintendent concludes, that Bode's truly invaluable Catalogue is the produce of his, Bode's, observations; whereas I very much doubt if a single star, of the many thousands it contains,

has been determined by this “ great observer.” But, again; “ lately, Professor Airy at Cambridge could only observe one in more than a year; and for this he could find no corresponding observation elsewhere.” This by no means astonishes me: the Professor has no equatorial instrument: his time is far too valuable to be thrown away in hunting after occultations, whilst such imperfect aids are furnished him by the Nautical Almanac for finding the time of the disappearance or re-appearance of the star. In short, the cause of so few occultations being observed is partly explained by the Superintendent when he tells us that “ the elements published in the Nautical Almanac are equally applicable to all places,” and are consequently applicable to none.

Further information, however, is to be obtained from this paragraph; for we are told, that “ whatever may have been said in the times of Halley or Ptolemy, corresponding observations, in the present state of the lunar tables, are perfectly superfluous for the purposes of nautical astronomy.” Where did the learned Superintendent gain this knowledge? Is it the result of his own experience? or did he derive it from Captain Heywood or Captain Beaufort; from Captain Owen or Captain Parry; from Captain Smyth or Captain Beechey; from either of the Captains Ross; or from Captains Copeland, King, Foster, or Lieut. Raper; or from Capt. Horsburgh, or any of the skilful commanders of the East-India Company’s ships? His assertion is unequivocal. I challenge him, therefore, to bring me forward one scientific navigator who will vote any means superfluous which are likely to lead to the knowledge of a ship’s position. Perhaps, however, the learned Superintendent may think that philosophers on shore know better what seamen want than they do themselves. Be it so; let me then recommend him to ruminate over the following passage contained in Mr. Herschel’s paper, read at a meeting of the Board of Longitude, held April 5, 1827.

“ Much has been said in objection to increasing the list of occultations, and carrying it down to the stars of the sixth and seventh magnitudes. They have been declared of comparatively little use at sea, even if observed, by reason of the long calculations they require,

which are said to be incompatible with the immediate urgency of the sailor's wants. Yet an occultation is but the most perfect possible of lunar distances, freed by nature from all instrumental errors, and the method of computing the longitude for one observed at sea, as stated by Dr. Young in the additions to the late Nautical Almanacs, if longer in one respect, is shorter in another, and much simpler than the working of a lunar: so that this objection is untenable."

To believe, therefore, as our Superintendent would have us, that the most accurate mode possible of observing a longitude is perfectly superfluous, involves an absurdity, which, to expose any further, would be breaking a fly upon the wheel.

" On the essential improvements which he has introduced into the computation of an observed occultation, assisted as he has been by the able contributions of Mr. Henderson, of Edinburgh, the Superintendent is willing to rest his claim to approbation or censure, with regard to the conduct of the Nautical Almanac. Mr. Herschel, in the printed paper accompanying the Memorandum, has remarked, that ' the method of computing the longitude from an occultation observed at sea, as stated by Dr. Young, in the additions to the late Nautical Almanac, is much simpler than the working of a [common] lunar observation.' "

Now, what part of the process may be the Superintendent's own, and what portion Mr. Henderson's, I care not. That the conduct of the Nautical Almanac is to be vindicated by any mode of computing an observed occultation, whether good or bad, I have yet to learn. With equal propriety might the learned Superintendent have brought forward the expert manner in which he cures a patient; or his recent discovery in Life Annuities, contained in " the popular Quarterly Journal " of January last.

" It was agreed by the Board of Longitude that this method should supersede the antiquated and compa-

ratively useless computation of the phenomena of such occultations only as are visible at Greenwich."

Now, what happened at the secret conclaves of the Board of Longitude it is impossible to say. Enough, however, — nay, more than enough, — is known, to convince the most sceptical that many things were there done that ought not to have been done; whilst many things were left undone that ought to have been done. To enter, however, into the various proceedings of that Board would be foreign to my present purpose.

" But, consistently with the general principle of omitting no useful hints to astronomers that could be easily obtained, it was thought right to distinguish, by a rough estimation only, such conjunctions as were likely to exhibit either occultations or near appulses in some part of Great Britain; and an asterisk was attached to these conjunctions, without any precise definition of its signification, in order that it might direct the attention of astronomers to a more minute examination of each case, while it would have been evidently impossible to vouch for the perfect accuracy of each asterisk, without entering into these very computations which had been judged superfluous."

Now, I would ask, were the proceedings of the Board entered in any minute-book? If so, I call upon the Board's late secretary to publish the voucher which gives to the above paragraph its authenticity. What right has the Superintendent, — nay, what right had the Board, — to suffer him to prefix asterisks to the announcement of phenomena, without giving a precise definition of their signification? Again, as regards "rough estimation:" where is there any thing of the kind alluded to in the Nautical Almanac? The Almanac, bad as it is, would be polluted by the appearance of the words referred to. Which of the Board will come forward and sanction it?

" It has happened that two or three of these asterisks have been found inconsistent with the expectations of such

astronomers as chose to believe that they were all meant to denote occultations positively visible at Greenwich ; while one of them, relating to the month of December last, which has excited the loudest clamours, as happening early in the afternoon, is actually inserted in the Connaissance des Temps, as visible at Paris, with the precise time of its occurrence there.

In reference, therefore, to these asterisks, the Superintendent gives us to understand, by the insertion of the word “all,” that some of them were intended to mean, that the occultation of the star to whose conjunction in right ascension they are affixed, would be positively visible at Greenwich ; whilst others meant they would be invisible at Greenwich.

Now, as I am one of those who chose to believe that the asterisks were all meant to denote occultations positively visible at Greenwich, let me defend myself from the Superintendent’s sneer. In the Nautical Almanac, in 1767, as at present, the eclipses of Jupiter’s satellites are computed : some of them being visible at Greenwich, and some not ; — just so the Superintendent’s occultation stars ; some are visible at Greenwich, whilst others are invisible. How did Dr. Maskelyne — how does the Superintendent himself — distinguish the visible eclipse of Jupiter’s satellite from that which is invisible ? By prefixing to it an asterisk. Was it, then, unreasonable to conclude, when an asterisk is employed amongst occultations, that it should imply the same thing ? And is the Superintendent to be allowed to shield himself by such a contemptible subterfuge, such an after-thought as this ? Let him shew, if he can, the most trifling hint in any part of the Nautical Almanac, or even in his “Popular Journal,” indicating that the asterisk, when applied to Jupiter’s satellites, implies Greenwich ; but that when attached to occultation stars, it means Great Britain !!!

But to return to the Superintendent ; and as a climax to all that has preceded it, I have to quote the concluding part of the sentence. “While one of these occultations, relating to the month of December last, which has excited the loudest clamours, as happening early in the afternoon, is actually inserted in the Connaissance des Temps as visible at Paris, with the precise time

of its occurrence there." I will, however, tell the sagacious Superintendent, that it was invisible at Greenwich, and that it was likewise invisible at Paris : I will also, as he thinks himself unvanquished upon this point, (and, I doubt not, he is the only man in the country that does think so,) introduce to his notice another instance of " practical imbecility" of a like nature. On the 4th of last month we are informed that the star θ Aquarii would undergo visible occultation by the moon in the day-time, the apparent conjunction being at three o'clock in the afternoon. This star is of the 4th or 5th magnitude, and has about $8\frac{1}{2}$ deg. of south declination ; so that the sun was only $2\frac{1}{4}$ deg. north of it, and 52 min. of time to the east of it !

With pain I must revert to that portion of the paragraph upon which the Superintendent has forced me, as I was the person who excited the clamours ; and again do I declare the occultation on the 5th of December to have been invisible. The star alluded to was ζ Piscium ; and to overwhelm me, the heavy artillery of the *Connaissance des Temps* is brought forward ; the Superintendent boldly and deliberately averring, that this occultation is " actually inserted in that work as being visible at Paris, with the precise time of its occurrence there." Turn we, therefore, to the *Connaissance des Temps*, p. 157 ; and what do we find ? Why, " actually" that not one word of the Superintendent's assertion is *truth*.—I leave him to his own reflections.

" The Superintendent has published from time to time, in a periodical work, the particulars of a great number of these and other phenomena visible in London, which have been most kindly furnished to him by Mr. Henderson."

This is perfectly true, and shews us, in the most unequivocal manner, that the Superintendent is interested in the omission of much astronomical information which ought to be contained in the Nautical Almanac. If such calculations as he alludes to were inserted in the Nautical Almanac, the contributions so " kindly furnished him by Mr. Henderson" could not have been saleable to the proprietors of any periodical work. In short, the very circumstance of a Superintendent being interested in

the support of a periodical journal is, *primâ facie*, dangerous to the honest discharge of the duties of Superintendent to the Nautical Almanac. But as another opportunity will be presented of referring to this “popular journal,” I shall say no more on the subject at present.

OBJECTION V. — “*The tables of the sun are inaccurate.*”

Answer. — “*Another objector has stated this inaccuracy as amounting to fifteen seconds, and as rendering the Almanac barely correct enough to ring a dinner-bell by it.*”

In the year 1818, certain discordances between the sun's computed and observed right ascension attracted my attention. For the first few months, seeing that the discordances shewed sometimes consistency and sometimes irregularity, I suspected that some portion of the latter might be owing to my transit instrument being unequally affected on different days by the influence of the sun's rays ; and under this impression, to put the matter to experimental test, my five-foot equatorial, which, as I have elsewhere stated (Phil. Trans. 1824), was capable of well doing its duty as a transit instrument, was almost constantly employed as such during 1818 and 1819. Discordances, however, between the sun's calculated and observed right ascensions still continued, though with much more appearance of regularity than when the smaller instrument was employed. It was, therefore, manifest, that, for the developement beyond contradiction of the origin of the discordances, an instrument of a more simple construction was indispensable ; and hence it was that, in the autumn of 1819, I prevailed upon my excellent friend, Mr. Troughton, to undertake for me the construction of one. That *chef-d'œuvre* of optical engineering was erected in my Blackman Street Observatory in June 1820 ; and a few weeks use of it convinced me that the discordances I had found were not the result of instrumental inaccuracy. Hence it was, that, in a paper published in Mr. Brande's Journal of January 1st, 1821, I wrote as follows :—“ This allusion to the sun brings me to the mention of a circumstance, not, I believe, generally known ; namely, that the error of the clock, as shewn by his (the sun's)

transit, is not unfrequently very far from the TRUTH : indeed it is a fact, upon which reliance may be placed, that whilst the errors of the clock, as deduced from several sidereal transits, shall not differ from each other above two or three hundredths of a second, the sun's transit will give one varying *three* or *four* TENTHS ;* and that, too, where the instruments employed are of the larger sort, and where every precaution is constantly taken to prevent the sun's rays from deranging the position of the instrument."—(Vide Journal of Science, Jan. 1, 1821, p. 430.) A copy of this paper I sent to the Superintendent. Did he endeavour to gain evidence to corroborate my assertions? Did he institute any investigation of the matter? Did he use the influence which his station of Secretary of the Board of Longitude gave him, to invite the attention of astronomers to the subject? No—and, as if to prevent further investigation, he embraced the first opportunity to tack a tail-piece to the Nautical Almanac next published, stating, that “the existing tables of the sun, as far as they have been examined, appear to be already sufficiently accurate for every purpose of practical astronomy.”

In April 1822, I published a pamphlet, entitled “Practical Observations on the Nautical Almanac and Astronomical Ephemeris;” wherein, amongst other inaccuracies, I shewed discrepancies between the sun's observed and computed right ascensions, amounting to one second of time, and stated, that “surely differences such as these were worthy of investigation.”—(Vide Practical Observations, p. 15.) I further declared, that the consequence of employing the sun's right ascension, as given in the Nautical Almanac, for procuring mean time, “however suitable to the wants of culinary philosophy, was only calculated to entail on astronomical observations needless labour, lamentable uncertainty, and, I might almost add, constant error.” This pamphlet was also read by the Superintendent: what was the consequence? why, that the same flippant sentence, attached for the first time to the Almanac on the very first opportunity after my previous declaration in 1821, was likewise attached to the

* Had the more recent catalogue of Mr. Pond been employed, the quantities here given would have been represented by *six* or *seven* tenths.

succeeding volume. During the years 1821 and 1822, every favourable opportunity was embraced to prosecute the inquiry; and although the particulars were not detailed till 1826, still I will undertake to say, that there was no astronomer of repute in Great Britain who was unacquainted with the nature of the results; and in London few who had not, from time to time, read the experiments as entered in the rough journal. Probably there was not one of my astronomical friends who had not witnessed, on some occasions, the *modi operandi et observandi*; for the proceedings in my observatory ever were, and ever shall be, accessible to all competent to understand them. The man of business may have secrets, the man of science should have none.

“ This context has actually had the effect of leading even astronomical readers to understand fifteen seconds of time; while, in fact, the charge extends to a single beat of the clock only, which is little more than the discordance very often found between two astronomers in the same observatory, both considered as excellent observers.”

Now, who these astronomical readers were that understood from the “context fifteen seconds of time,” I will not inquire; my words are, that “the sun’s right ascension is erroneous only 366 days in the year; and oftentimes, as on this very day, by a quantity equal to fifteen seconds;” these words I repeat, and defy the Superintendent to prove their fallacy. But it seems the quantity fifteen seconds, or one second of time, as I will now call it (lest any other “astronomical readers” should be ignorant that fifteen seconds of space and one second of time are synonymous expressions), “is little more than the discordance very often found between two astronomers in the same observatory, both considered as excellent observers.” Is it so? Where did the Superintendent make this discovery? The following facts, however, may perhaps induce the Superintendent to think less unfavourably of the skill of observers:—On Sunday, March 22, the sun’s right ascension on my meridian was determined by me with the transit instrument, and with the transit circle by a gentleman who was present; again, on

Wednesday the 25th, it was observed by me with the transit circle, and by another gentleman with the transit instrument. Now, the difference between the one gentleman's determination and my own amounted to twenty-four hundredths of a second of time; whilst the difference between the other's observation and mine amounted to one-tenth. Nor can I consider either the one or the other "excellent observers." The latter gentleman is well known to the Superintendent, being no other than Mr. Henderson, of Edinburgh; whilst the former, till then, had never taken a transit of the sun in his life. It is right also to say, that no extraordinary care was taken on either occasion, as the Superintendent's libel on practical astronomy (for such I deem his assertion to be) had not then made its appearance, nor were its contents known to either of us, unless to Mr. Henderson, which, however, I scarcely imagine to have been the case.

But should the Superintendent retain, after this, any doubt upon the subject, I can only say, that, as my observatory contains two excellent transit instruments, and is in this respect probably more adapted to put the matter at rest than any other observatory with which I am acquainted,—whenever he pleases, I will undertake to teach him so far to surpass his present ideal accuracy of "excellent observers," that, in a short time, he, the Superintendent, shall, *propria personâ*, be able to observe the transit of the sun with either of my instruments, which, when reduced, shall not differ once in twenty instances three-tenths of a second of time, and which shall frequently accord to two or three hundredths of a second, either with my own, or any other experienced observer's determinations.

"It is, however, only a very few years since that the error of the solar tables was publicly noticed and admitted; and the paper devoted to the subject in the Philosophical Transactions bears witness that the Superintendent had not been inattentive to the subject, for it contains a comparison of a year's observations at Greenwich with the tables which had been made by one of his computers. Professor Bessel is still engaged in an investigation of stupendous extent for the improvement of the solar

tables, and it will probably be thought right to await the appearance of his new tables before those of Delambre are entirely discarded; and, in the mean time, Professor Airy has obligingly undertaken to continue the communication of the results of his own very important investigations, for the temporary correction of the tables."

Now, whether the public notice of the error of the solar tables can be said to be only of a "very few years" standing, I cannot decide, as it will, of course, depend upon the definition assigned to a "very few years;" I have, however, already shewn, that public notice of the subject was given eight years ago; and, one year before, I published a pamphlet, to which the Superintendent has done me the honour to allude satirically in a paragraph (which I shall notice in due time), and which pamphlet he there states I published "many years ago;" thus, then, *seven* is the number which constitutes *many* years, whilst eight implies but a very few years.

The paper in the Philosophical Transactions alluded to by the Superintendent was mine; and the year's comparison of the Greenwich observations with the "Superintendent's computer's" tables, although not the tables for which he asked admission, were still allowed to be printed with it. He has not mentioned the date when these tables and comparisons were made; lest, therefore, I should take the wrong instead of the right, I shall say no more about them. A degree of convenient vagueness in the Superintendent's writing makes him sometimes a slippery personage to grapple with. But it seems that it is only "a very few years since that the error of the solar tables was admitted;" indeed! is it, then, admitted? This is indeed important, and entirely unexpected. Since I had the honour to present to the public, in 1826, the paper to which the learned Superintendent alludes, he has published three successive Nautical Almanacs; namely, in 1826, that for 1829; in 1827, that for 1830; and, in 1828, that for 1831: now, on referring to every Almanac published since my first allusion to the error of the solar tables till the publication of my paper in the Philosophical Transactions, and in every one published since

that time till the present moment, we are assured that, “as far as the existing tables of the sun have been examined, they appear to be already sufficiently accurate for every purpose of practical astronomy.” But to have withdrawn this paragraph would have been to acknowledge the inaccuracy of former assertions; and at that time my appeal to the public, which now forces the Superintendent to contradict in one document what he has pertinaciously adhered to in another, was not at all anticipated.

But we are farther told, that “Professor Bessel is still engaged in an investigation of stupendous extent for the improvement of the solar tables,” and that “it will probably be thought right to await the appearance of his new tables before those of Delambre (the present tables) are entirely discarded.” Thus, then, we see that these tables, which the Superintendent last October assured us, in the Nautical Almanac, were “already sufficiently accurate for every purpose of practical astronomy,” are, on the Superintendent’s own authority,—*now* to be abandoned: indeed, so bad are they at present found to be by their recent eulogist, that even the temporary correction of them by Professor Airy is hailed by the same individual with grateful acknowledgment.

“The new lunar tables of Damoiseau have already been submitted to an examination; but, however creditable to the talents of the author, they do not seem likely to supersede in practice those of Burckhardt, which are at present employed.”

That these tables have been examined, I am glad to find; although when, or by whom, we are left in ignorance. It is to be hoped, however, that those to whom this important trust was assigned were competent more correctly to decide upon their merits, than were the canonical examiners of the solar tables.

OBJECTION VI.—“*The four new planets are not mentioned.*”

Answer.—“*The Board of Longitude had resolved, whe-*

ther superfluously or not, to insert the places of the new planets as soon as good tables of their motions could be procured, and had even taken measures for the construction of such tables. Perhaps in time they might have added the planetary comets to the work, and then the comets at large, a copious table of which was published by the Superintendent, as communicated to him by Dr. Olbers, of Bremen, the discoverer of two of the planets."

It has long been our reproach to have imported from abroad all our planetary tables: it would, therefore, be highly desirable to become exporters. May I, then, hint to the Superintendent, who, as Secretary of the Board of Longitude, doubtless has the theories of these several planets at his fingers' ends, how honourable it would be to the "only English mathematician on the list" of the Academy of Sciences, were he to present that learned body with "correct" tables of them by himself, as an inaugural dissertation!!

In the pamphlet of 1822, p. 31, I wrote as follows: "Why the places of the planets Ceres, Pallas, Juno, and Vesta, are not to be inserted, it is difficult to divine. I am aware it may be said, that the elements of these are not sufficiently ascertained to enable mathematicians to assign to them accurately their stations. Granted. This, however, is the very reason why their approximate places should be published; since, thereby, inducements would be held out to observations of them, which, affording numerous facts, would soon furnish fresh work for physical astronomy, and enable it to distribute to us knowledge, instead of our present comparative ignorance relative to them." But, perhaps, as one of the Superintendent's "lovers of practical astronomy," I naturally "may be inclined to exaggerate the importance of the objects which engross my own attention." Be it so: let us then refer to Mr. Herschel's paper, read before the Board of Longitude in 1827, where we find his sentiments expressed thus:

"The places of the four new planets are not given in the Nautical Almanac. They are, however, the more essential in an astronomical Ephemeris, as it is impossible to find them

without, as they cannot be seen by the naked eye, or known from stars when seen in telescopes. This deficiency ought to be supplied. If it be said there are no perfect tables of their motions, still imperfect places are better than none at all; and it is so much the more necessary to get them observed." — *Vide Mr. Herschel's Paper, inserted in page 5 of the Parliamentary Report.**

OBJECTION VII.—“ *The tables used for the reduction of the stars should be uniform.*”

Answer.—“ *These reductions have hitherto been principally computed at Greenwich: as soon as astronomers are sufficiently agreed in their very minute elements, it may become practicable to adopt a more strictly uniform system respecting them than has hitherto been employed.*”

We are told, in reply, “ that the reductions have hitherto been principally computed at Greenwich.” From this it might appear, that the memorialists had supposed they had been computed at Jerusalem. But what has this to do with the matter? or are we

* British astronomers will rejoice, that the opportunity of observing two of these planets during their ensuing oppositions, by the fortunate arrival, during the last week, in this country, of the Bologna Ephemeris, is now furnished them. I avail myself, therefore, of the means which this pamphlet affords me of distributing the *important* information.

BOLOGNA EPHEMERIS, 1829,

Pages 25, 31, and 37.

VESTA.				JUNO.			
		Æ.	Decl.			Æ.	Decl.
		h.	m.			h.	m.
April 6	15	2	— 4° 58'	May 6	16	56	— 5° 13'
— 16	14	56	4 24	— 16	16	49	4 28
— 26	14	47	3 36	— 26	16	41	3 52
May 6	14	38	3 10	June 5	16	33	3 27
— 16	14	29	3 0	— 15	16	25	3 16
— 26	14	21	3 11	— 25	16	18	3 18

to conclude, that as reductions may be made in various ways, that those made in the same village must, *ex consequentiâ*, be uniform? However, the Superintendent seems to have some idea of the propriety of the observation contained in the “Memorandum:” for, as soon as some things are done which are not done,—or, in other words, when a few more attacks of his strong holds have been made—he will surrender this point, as he has done divers others. For the benefit, however, of the learned Superintendent, as he has inserted Professor Airy’s name for one purpose, I will take the liberty of inserting it for another; namely, to tell him that so recently as February last, did that distinguished individual state to me, that if Schumacher’s Ephemeris did not shortly arrive in England, he should be compelled to use the Nautical Almanac!

OBJECTION VIII.—“*Observatories are paralysed for want of a better Ephemeris.*”

Answer.—“*It may be granted that the Nautical Almanac does not contain every particular that might be desired by some lovers of practical astronomy, who wish to spare themselves, as much as possible, every exertion of their faculties in computation.*”

Now, who are the Superintendent’s “some lovers of practical astronomy,” I cannot say. As, however, I should grieve not to be included in the list, I will tell him what I want; namely, every astronomical notice which is to be found in any Astronomical Ephemeris in existence: and if even some slight improvements could still be suggested, I should not refuse to profit by them, well knowing that persons of the highest acquirements, when intent on the arduous duties of an observatory, should be furnished with every thing possible that can spare the unnecessary “exertion of their faculties in computation.” But of the business of an observatory, or what is wanted by industrious observers, or “lovers of practical astronomy,” the Superintendent has no more an accurate idea, than he has of what is passing in those worlds which are the objects of the observer’s notice.

“ But it must be allowed, that, without any culpable or even ridiculous partiality for their favourite pursuit, the exclusive cultivators of any single branch of science must naturally be inclined to exaggerate the importance of the objects which engross their own attention.”

May I remind the author of this cynical sentence that almost all the grand discoveries, from the earliest ages, have been made by persons whose attentions have been confined to one department of scientific investigation ; whilst few, indeed, in number, and fewer in importance, have been those with which scientific harlequins have enlightened us.

“ The complaint is, however, at this moment, particularly ill timed, when Encke’s excellent Ephemeris is allowed to be precisely such as to satisfy the utmost imagination of the astronomical observer : such an Ephemeris could not be computed in this country without an enormous expense ; and if incorporated with the lunar distances, would become far too bulky for the common use of seamen.”

Here, again, we are at issue ; and with all becoming deference to my special-pleading antagonist, I think the moment particularly well timed, when we have before us an example of what a little state of Europe not only can do, but absolutely does, for the observer’s wants. Does the Superintendent mean to include Encke, too, amongst those “ lovers of practical astronomy who like to spare themselves, as much as possible, every exertion of their computing faculties ?” The only difference between the “ lover of practical astronomy” and the Superintendent is, that the former follows the pursuit, and pays for following it ; whilst the latter is paid, and by the public too, for persecuting it.

But the enormous expense which would, in this country, attend getting up such an Ephemeris as Encke’s, is next brought against us. I trust that the day is not far distant when a Committee of the House of Commons will compel the Superintendent to translate the word “ enormous” into pounds, shil-

lings, and pence, and force him to confess that it was introduced in order to alarm, on the score of economy, those to whom his report was made—in other words, in order to deceive them. Have they not imagined that he alluded to thousands? With what indignation, then, will they not learn, when he is examined, that the calculation of all the additional matter for which we ask, would not cost above 200*l*. I had some idea of proposing, for our seamen's benefit, that the lunar distances should be given for every hour, in lieu of every three hours, as at present; but I dare not, lest they should render the Almanac so “bulky” and ponderous as to endanger the ship's safety.

“OBJECTION IX.—“ *Mr. Herschel has pointed out many improvements which might be made in the Nautical Almanac.*”

ANSWER.—“ *The greater part of Mr. Herschel's suggestions have already been subjected to an experimental publication for two years, upon a plan which he approved, in the form of a Supplement to the Nautical Almanac, which it was proposed to continue, and perhaps to enlarge, if the generality of astronomers considered it as of importance, and if the test of its sale gave reason to suppose that its circulation would be extensive. The result has been fully sufficient to prove, that it would be a great prodigality to print 7000 copies of such a Supplement; and, very fortunately for astronomers, the question of its continuation, in any form, appears to be effectually set at rest by the appearance of Encke's Astronomical Ephemeris of 1830; a work which, without any matter exclusively nautical, contains all that an astronomer on shore could require, and of which it would be highly desirable to facilitate, as much as possible, the ready importation into this country. With respect to the probability of any classical Ephemeris of this kind paying its own expenses in England, a man must be very little acquainted with the mysteries of book-making and book-selling who could seriously entertain such an imagination.*”

What were Mr. Herschel's suggestions besides those which the Board of Longitude has published, I know not. I do, however, know, that some of the most important have not been adopted. But if the Superintendent would quote more fully, or, at least, less partially, he would have furnished us with that paragraph wherein Mr. Herschel expressly declares, "Were it considered desirable to make a perfect Astronomical Ephemeris, a very great deal more than I have mentioned, both for information and convenience, might be added with advantage." Will the Superintendent condescend to inform us what of this "very great deal more" here alluded to by Mr. Herschel has been subjected to experimental publication? The fact is, the Supplement, poor tool as it is, has never had a fair trial: its birth was difficult, and since it came into the world no pains have been taken to rear it. No means have been employed to procure its sale; and so successfully has its very existence been screened from notoriety, that there are many astronomers, within an hour's walk of London, who, till this Nautical Almanac conflict took place, knew not that any such Supplement had issued from the press. The volume for 1828 did not make its appearance till the spring of the year; and as for that of the present year, a friend of mine could gain no tidings of it at the publisher's five days before Christmas.

"The result, however, has been fully sufficient to prove that it would be a great prodigality to print 7000 copies of such a Supplement." Here we are of the same opinion, though it is probably upon very different data: he, because it does not sell; and I, because it is not worth the purchase-money. But why there is any reason to congratulate astronomers that it should terminate its biennial existence next December, I know not; nor can I tell why it would be "highly desirable to facilitate, as much as possible, the ready importation into this country" of Encke's Ephemeris, unless, indeed, it be that the astronomical part of our Nautical Almanac being no longer needed, nothing may remain in it except what the Superintendent may be pleased to consider alone necessary to navigation, which might be at least as well done for 50*l.* a-year, under the direction of a parish school-master, as it is at present executed by the Superintendent and his helpmates for his 300*l.* a-year, and their 960*l.*;

and which, moreover, might be sold, after a profit to the publisher, for sixpence a piece.

As to the Superintendent's opinion about the "probability of any *classical* Ephemeris" such as Encke's "paying its own expenses," it is unworthy of consideration: the object is of far higher national import than the gain or loss of a few pounds. But might it not be supposed, from his expressions, that the present Nautical Almanac does pay its own expenses? whereas, the average loss for the last five years has been 1007*l.* per annum. Now, without pretending to rival the Superintendent in "the mysteries of book-making and book-selling," I will venture my opinion, that the better article will command a better market, and that every improvement will add to the number of purchasers.

"But there is no reason why any collateral trials of this kind should not be made, if it could be done without danger to the Navy on one hand, and without injustice to the old and faithful servants of the public on the other."

Now, by "collateral trials" I suppose the Superintendent means an Astronomical Ephemeris with its "improvements or innovations;" but how that is to expose the Navy to danger, (the daily, the nightly, nay, the hourly object of the Superintendent's solicitude,—witness the lunar planetary distances and the planetary Ephemerides, which he has had in store for them nine years) which will furnish our seamen with additional means of preservation, I cannot possibly divine; but the other, or left-handed part of the sentence, is comprehensive enough; and when all the cant about "injustice," and "old and faithful servants of the public," is removed, means simply—provided, however, the Superintendent be allowed to go on pocketing 300*l.* a-year, for doing that which might be better done for nothing. If, however, any of "*his* computers" be too advanced in years to compute from new formulæ, as I believe they have done their duties with credit to themselves, as well as with comfort to the Superintendent, pension them with all my heart; and as to the Superintendent, if

the principle of vested right is to be advanced, pension him too, rather than go on in our present deplorable state.

“ With regard to the addition of miscellaneous matter, resembling that which accompanies many of the foreign Almanacs, the Superintendent of the Nautical Almanac did make a proposal, soon after his first appointment, to add to it such an appendix; but it was not thought necessary that the public should bear the expense, and the design was in a great measure executed in a manner more congenial to the habits of this country.”

As to the omission or insertion of any appendix, similar to that contained in many of the foreign Ephemerides, I *need* not here reply; because my great object is the improvement of the tabular and essential part of the Nautical Almanac, and not the insertion of any supererogatory matter; and to the latter part of the above quotation I *cannot* reply, because I do not know to what it alludes.

“ A separate volume was first published containing a commentary on a part of Laplace’s Celestial Mechanics, and since that time the astronomical and nautical collections have regularly appeared in a popular quarterly journal, containing much original matter, and many selections from the best continental works in all languages. Whatsoever may be thought of the merit of these publications, they at least serve to shew that the omission of similar papers in the Nautical Almanac has not arisen from any personal inactivity or inattention on the part of the Superintendent; and if the journal has been thought expensive, the members of the Royal Society at least have no reason to complain of its being difficult of access, since a copy has always been gratuitously offered to their acceptance.”

Now, whether this separate volume, this “ commentary ” on the *Mécanique Céleste* of Laplace, was published at the

expense of the public, does not appear, nor is it probably a matter of very great importance. But why matter furnished by the Superintendent of the Nautical Almanac to a periodical journal, over which the public have no control, is to be brought forward as a proof that the “omission of similar papers in the Nautical Almanac has not arisen from any personal inactivity or inattention on the part of the Superintendent,” I am really at a loss to conceive: investigate the matter, and what do we find?—why, that the Superintendent has connexion with a periodical journal, to which he communicates quarterly the various scraps he collects from one, and the different tracts he gets from another, and for which he in return obtains from the proprietor so much a year or so much per sheet; moreover, instances exist wherein the Superintendent has published astronomical information in the Nautical Almanac, whilst for the explanation of it reference is made to this very journal; thereby constituting the journal a sort of vade mecum to the Almanac, and the latter an advertising medium for the former. We are then told, if the journal alluded to “has been thought expensive, the members of the Royal Society at least have no reason to complain of its being difficult of access, since a copy has always been gratuitously offered to their acceptance.” Thus, then, it seems that the favoured few are the Royal Society members. I presume, however, that the Nautical Almanac was not intended for the use of the Royal Society only; and what satisfaction it can be to the sailor to be told that the resident members of the Royal Society can con over, for nothing, four books a year, for which he is compelled to pay thirty shillings or not to see at all, I leave others to determine. But the evasion is frivolous: other periodical journals furnish more astronomical knowledge to the public than does this *popular* journal; and they have also always been gratuitously offered to the Royal Society, as well as that to which the Superintendent is a stipendiary contributor.

I will now pass by the three next paragraphs till I have disposed of the last but one.

“Among the ninety-five stars employed for the elements of occultation, a correction of a few seconds was found to

be requisite in the tabular places of four ; this error does not supersede the utility of the elements as affording an approximation to the true result, which might easily be corrected by a reference to other authority ; but it has been made the subject of a severe attack on the work by a gentleman who recommends the elements of the whole ninety-five to be expunged as an encumbrance. It is well known that such errors in the places of stars may be found among the best authorities ; many of the stars of which the places are ascertained within half a second at Greenwich, exhibit a variation of fifteen or twenty seconds of space in the Catalogue published by the Astronomical Society, which is still acknowledged to be extremely valuable to practical astronomers as well as to nautical observers."

Now, it seems that the error in the tabular places of four of the Superintendent's luno-sidereal acquaintances " does not supersede the utility of the elements as affording an approximation to the true result." In my Reply, &c. page 27, I said, " refer to the Nautical Almanac for next year, and see it there unblushingly avowed, that the elements of occultation of no less than four stars are actually unfit for use. Not as far as concerns the current year only, but that they have spread their poisonous principles in more than 500 instances through the preceding six." I will now refer to the Nautical Almanac for 1830, and opposite to the very first page stands the following acknowledgment : — " From errors in the tabular mean places of α χ , μ Π , ϵ η , and ι β η , the elements of occultations for those stars in the Almanacs of 1824—1829 become unfit for use." That I have not distorted the Superintendent's words is unnecessary for me to state ; but whether his own assertions accord so well as might be wished, others may determine.

But these elements for computing the principal lunar occultations of the fixed stars have been severely attacked by a " gentleman who recommends them to be expunged as an encumbrance : " to this I unhesitatingly plead guilty ; and as I gave the grounds why I did so, which have been too strong for the Superintendent to overturn, I shall say no more about the

matter, except that as forty-eight errors in the Nautical Almanac are pronounced to be synonymous with one, so perhaps the tabular places of four being erroneous, four may be deemed equivalent to 192. It is distressing to see a man of the Superintendent's calibre of mind endeavouring to screen himself under shelter of the origin of those errors: let me, however, shew him that his defence is untenable. The first thing an accurate Superintendent should do, is to take especial care that his primary or radical tables are correct; if any fault lurk there, he ought to know, that all his results derived from them must be faulty also; and that to the person who is misled by errors, it is no consolation to know that they have a trifling origin. The Superintendent having built a house, and paid for it as a substantial one, would feel it little excuse did his architect say, a year or two afterwards, " 'Tis true your house has tumbled about your ears; but it is only in consequence of four rotten timbers I inserted in the foundation of it." Just so with errata in Astronomical and Nautical Ephemerides; an error is an error, and all the sophistry of the Superintendent cannot make it otherwise.

But these radical errors must be palliated, now that their descendants are whitewashed; and we are told, "it is well known that such errors in the places of stars may be found amongst the best authorities." Now, where these "best authorities" are, I do not know; I should, however, be inclined to call them by another title. But that the Astronomical Society's Catalogue should be brought in to give a colour to the matter, shews at least the Superintendent's adroitness. That catalogue was composed from the observations of three or four individuals, made at different epochs and with different instruments; it contains the places of many stars tolerably well determined, but of more whose places are not, and never were by the Society, considered accurate: it was arranged as a nucleus on which other catalogues might be formed, but more especially for the express purpose of having it examined and verified; and as an inducement to astronomers to undertake the task, the means of easily procuring the necessary reductions were adjoined. It is to be considered, in the present state of astronomical science, a useful auxiliary to observers who

may feel disposed to make differential observations ; and, as such, is extremely valuable to practical astronomers, as well, perhaps, as to nautical observers. But as a standard catalogue, no one, it was thought, would ever have brought it forward. As to the fifteen or twenty seconds, of which the Greenwich observations, according to the Superintendent, vary with that catalogue, the causes of such discrepancies (if they exist) must not be hastily assigned to error : let me remind the Superintendent there is such a thing as proper motion among the fixed stars. The Superintendent's tabular 4, however, which have spread their poisonous influence through the Nautical Almanacs of six successive years, are of a very different cast to those of the Astronomical Society's Catalogue generally ; and are no others than four stars whose places have long since been determined with sufficient accuracy for any purpose for which the Superintendent wants them. That any errors, therefore, should be entailed on calculations in which they are concerned, is, I assert, the result of the most unjustifiable carelessness.

“ The reductions of the stars have been accused of inaccuracy, because the 29th of February is not set down in a Leap Year ; but it is no where promised that every tenth day shall be inserted ; and even if the numbers were erroneous, the error of a day would always be insensible. The reductions were first made at Greenwich, then re-calculated independently by a very accurate computer, and compared by the Superintendent with at least as much attention as the subject required.”

That “ the error of a day would always be insensible,” till informed by the Superintendent, I did not know ; that the reductions were first made at Greenwich, and then re-calculated by a very accurate computer, may be true, although it is somewhat singular that two computers should fall into the same error. But that their results were “ compared by the Superintendent with at least as much attention as the subject required,” I cannot allow ; or how happened it that in the year 1824, as well as 1828, the stars had no place in the heavens on the 29th of February ? why did the pole-star come to the

meridian an hour after its proper time? or why was the astronomically dangerous error in the right ascension of α Lyræ allowed to pervade four months of the year, whilst the blunder was not discovered till twelve months afterwards?

But, as if the Superintendent felt that evasion would not extricate him from his difficulties, he calls in still less justifiable aid, and adds, “but it is no where promised that every tenth day shall be inserted.” Now the Almanacs from 1822 to 1831 inclusive lie before me; and on the very first page of every one of them, and forming part of the very first paragraph of every one of them, stand the following words: “It has, however, been thought proper to annex to the Almanac a correct Table of Refractions, a Table of Second Differences, and the true or apparent places of sixty (or formerly twenty-four) principal fixed stars, *for every ten days* of the year, corrected for precession, aberration, and nutation.”

The two statements being now in juxta-position, the reader can come but to one conclusion. Were I, however, to express that conclusion, I might indeed be accused of personality.

But it is satisfactory to me to have as participators in my ignorance the “President and Council of the Royal Society, and the resident Commissioners of Longitude,” who, in their resolution of March 11, 1824 (which will be quoted hereafter, for another purpose), particularly mention “leap year,” in reference to the formation of the very tables from which these reductions are made. Again; Professor Schumacher has published reductions of the principal stars for every ten days. Does he omit the bissextile day? No such thing. But the example of “an impartial foreigner appears to have had no weight with the” Superintendent “of the Nautical Almanac.”

“It would be impertinent to add to this report a detail of all the answers that might readily be given to a number of other objections, still more unfounded and unimportant than those which have been mentioned; the style and tone in which they are expressed carrying with them a sufficient indication of the spirit in which they were written; especially as they chiefly originate with a gentleman who began his career of hostility against the Nautical Almanac with a mistake so extraordinary, that it must

have required no common share of courage to return to the attack. He published, many years ago, a number of plates representing his observations of the configurations of Jupiter's satellites, in order to shew that their latitudes were erroneously laid down in the *Nautical Almanac*, while it was well known to all Europe that the *Almanac* makes no attempt whatever to express their latitudes. In the *Connaissance des Temps*, the satellites are all set down in one line; in the *Nautical Almanac* they occupy two parallel lines, according to the direction of their motion; and the latitudes so represented could only have been a constant quantity north or south.

“A few of his later remarks are, however, somewhat more specious: he has accused the *Nautical Almanac*, with literal truth, though not with substantial justice, of some inconsistencies in the different phenomena of Jupiter. Now these phenomena have always been computed from tables possessing different degrees of accuracy, according to the purpose for which the computations were intended; hence have arisen some slight discordances, which are easily understood from the explanation given in the preface, and which are in themselves of no manner of importance. In May last the newspapers informed us that the same astronomer had observed an eclipse of a satellite which was marked invisible in the *Nautical Almanac*. It may be granted that he did see it: but it was rightly marked in the *Almanac*; first, because it was invisible, according to the tables of *Delambre*, which are the basis of the computation; secondly, because it really was unfit for correct observation, from its uncertainty, as happening near the limits of visibility; and, in the third place, the time of the eclipse was inserted, and correctly inserted, with a view to the possibility of its being visible,—and a computer could have done no more. The author of the tables expressly directs, that ‘à moins qu’à l’instant de la phase douteuse le satellite ne se trouve à une distance un peu sensible du bord de Jupiter, et est assez inutile d’en faire l’annonce; nous n’avons que trop d’observations douteuses.’ (P. lvi.)”

These paragraphs refer to me personally ; I have, therefore, deferred the discussion of them till the other parts of the Superintendent's answer had been disposed of.

It seems that the objections to the Nautical Almanac originate with me ; of this I was not aware, and as I feel the honour to be unmerited, "substantial justice" to another person requires that I should not appropriate it. In December 1821, Mr. Baily published a small volume of "Astronomical Tables and Remarks for the year 1822 ;" and in the April Number of Mr. Brande's Journal, four months after the appearance of Mr. Baily's work, I find a "Reply to Mr. Baily's Remarks," beginning thus :—"In a volume of astronomical tables for the year 1822, which has been privately printed, but extensively circulated for the convenience of practical astronomers, Mr. Baily has introduced several severe remarks on the Nautical Almanac, which have been considered by those who are better acquainted with Mr. Baily's general merits than with the actual state of the facts in question, as requiring some confutation or explanation." Now, whether the Superintendent is or is not the author of the reply of which the above is the first paragraph, I will not inquire ; suffice it to remember, that it stands in record before the public on the 1st of April, 1822 ; and that my pamphlet to which the Superintendent alludes, is dated April 15, 1822.

He next states, that I "published many years ago a number of plates, representing my observations of the configurations of Jupiter's satellites, in order to shew that their latitudes were erroneously laid down in the Nautical Almanac, while it was well known to all Europe, that the Almanac makes no attempt whatever to express their latitudes." Now, let me request of my readers to compare the "style and tone" of these shameless remarks of the Superintendent's with the following extract from the publication in question, which contains *all* I said on the subject of configurations ; and in which the word "latitude" is *not* expressed or implied.

"We now come to the last page of this publication, containing configurations of Jupiter's satellites at a certain hour of the night. Now, these are intended, doubtless, to inform the observer of the position of each satellite ; thereby enabling him to know which is the first, which is the second, &c. ; they also

teach him when a fixed star is near to the planet, which is the star, and which is the satellite: were the diagrams generally accurate, he would occasionally be led to look out for occultations of stars by the planet; phenomena certainly not unworthy of notice. Unfortunately, however, the configurations given in the two Almanacs before me are very rarely correct; I have examined them scores of times, and perhaps have found them once or twice nearly similar. Nor has this circumstance of the usual incongruity between the computed and the observed configurations escaped the notice of other observers. A member of the University of Cambridge, in my observatory, when interrogated by another gentleman on the subject, replied, ‘the configurations laid down in the Nautical Almanac are no more *like* those which I have from time to time observed, than they are like *any thing else*.’ I here subjoin a few diagrams, shewing the actual position of the satellites with regard to the planet at the time alluded to in the Nautical Almanac; they have not been selected for the purpose, but are a fair average specimen; they are not laid down by conjecture, but are the results of actual micrometrical admeasurement; and, comparing them with the corresponding diagrams in the Nautical, the distances, not less than the relative positions, will be found to justify the assertion I have made. There is also, in some instances, information calculated to excite a smile; for example, we are informed that, on Sept. 5th of last year, a satellite may be visible and invisible at one and the same time; for whilst page 99 tells us of the eclipse of the satellite, page 108 assures us that it is visible.

“ If, however, the matter is to be done at all, it should be done correctly; and perhaps the following proposition may be worthy of notice: — On the disk of Jupiter are seen an assemblage of dark streaks, commonly called belts; these might be considered points whereby the relative places of the satellites might be laid down; the belts might be added to the figure representing Jupiter, or the lines separating the configurations of one day from those of the next might be considered parallels to the belts, whilst the diameter of the planet might furnish data for giving to the satellites something like their real distances; so would there be no difficulty in obtaining, from configurations thus planned, useful information. If, however, some improvement in the present mode of exhibiting them is not adopted, I certainly

think, that the sooner they are discontinued altogether the better; as expense would then be saved, certainty of their leading to erroneous conclusions entirely prevented, and the page would then be open for other and more valuable matter."

To prevent misrepresentation of the terms, signs, &c. employed in the Nautical Almanac, Dr. Maskelyne appended to each volume about twenty pages of letter-press, entitled "Explanation and Use of the Articles contained in the Astronomical and Nautical Ephemeris." Referring to the first volume, viz. that for 1767, we find the following words:—"The configurations of Jupiter's satellites exhibit the apparent positions of the satellites with respect to each other, and to Jupiter, at such an hour of the evening or night as they are most likely to be observed." So says also each succeeding volume for upwards of sixty years, viz. to 1831. Let, then, the Superintendent refer to my very first diagram, namely, that for Sept. 4, 1821, and compare it with the configurations given by him in the Nautical Almanac of the corresponding date; his configurations assure me I ought to have seen but two satellites, whilst my diagram exhibits FOUR. Again, let him turn to his configurations of Nov. 4, 1821, and to my diagram of the same date; and let us see how far the satellites in his configurations exhibit "their apparent positions with respect to each other and to Jupiter" at the time indicated—the four satellites are visible in each; hence, therefore, we may compare their apparent positions to each other, and to Jupiter, without difficulty; taking the first, or the satellite nearest to Jupiter, as unity, we have the others in order of distance, represented by $1\frac{1}{4}$, $3\frac{1}{4}$, and 9; whereas by my diagram they will be represented by 4, by 11, and by 30. Thus much for "the mistake so extraordinary, that it must have required no common share of courage (in him who made it) to return to the attack." Again, let the Superintendent refer to his configurations of Jupiter's satellites on the memorable 29th of April last, when his Almanac, relative to three satellites, announced no less than four errors, — two of which he has ventured to palliate, — and let me ask him where was the fourth satellite at the time indicated? He represents it to have been on Jupiter's face; my observations deny the assertion. Nay, let me ask him where was the second satellite at two o'clock of the morning of the 2d of April? He says it was "behind Jupiter, eclipsed

by his body ;” I tell him, he might have said with equal truth, he had it in his pocket.

But as for his “latitude” story, it is of modern invention ; ransack the Almanacs from 1767 to 1824 inclusive, and not one word is said, or even hinted, about the “latitudes” of the satellites. In the Almanac for 1825, however, the following sentence was slipt in : “ [the latitudes are wholly neglected in these diagrams :]” Now this 1825 volume was the *first* Almanac published after the appearance of my pamphlet. The trick was artfully conceived, a future scapegoat was provided, and the Superintendent basked in the sunshine of probability, that I should not notice the period of its admission. *Sed non sic ignotus Ulysses.*

To the charge of “having accused the Nautical Almanac of some inconsistencies in the different phenomena of Jupiter,” it is needless to say any thing, since the Superintendent admits that I have done so with “literal truth.” It is, however, alleged, that these inconsistencies have arisen from the “different degrees of accuracy of the tables employed, according to the purpose for which the computations were intended ;” but it would have been full as well to have informed us, when and upon what occasions the good were used, and when and in what instances the bad were employed. I have waded through all the Almanacs to find in their various prefaces the explanations upon this matter, which the Superintendent asserts are to be found there ; not having, however, been fortunate enough to find them, I take the Superintendent’s words for granted, namely, that they “are in themselves of no manner of importance.”

But to proceed : the Superintendent states, “In May last, the newspapers informed us that the same astronomer had observed an eclipse of a satellite which was marked invisible in the Nautical Almanac :” he also adds, “it may be granted that he did see it.” The “style and tone” in which this admission is couched is “a sufficient indication of the spirit in which it was written.” Was ever insinuation more contemptible ?

“But this eclipse was rightly marked in the Almanac ; first, because it *was* invisible, according to the tables of Delambre, which are the basis of the computation ; secondly, because it really was unfit for correct observation, from its uncertainty, as happening near the limits of visibility ; and, in the third place, the *time* of the eclipse was inserted, and correctly inserted, with

a view to the possibility of its being visible,—and a computer could have done no more.” We will take them in order.

The Nautical Almanacs, from 1767 to 1831, uniformly assure us, that “the immersions and emersions marked with an asterisk in the Ephemeris are those visible at Greenwich.” Is this immersion marked with an asterisk? No: ergo, Dr. Thomas Young’s assertion is untenable, being utterly repugnant to the principles upon which the Nautical Almanac is founded.

Secondly, how far is Doctor Thomas Young borne out in his assertion, that “it was really unfit for correct observation, from its uncertainty, as happening near the limits of visibility.” That an eclipse of a satellite which takes place near the limb of the planet is less satisfactory, and certainly more difficult to observe, than when it occurs at a distance from the planet’s limb, requires not the *practical skill* of the Superintendent to inform us; but being more difficult and less satisfactory is one thing, and being really unfit for use is another thing; let me, therefore, judge of the observation from its results. The immersion computed for the Royal Observatory of Paris is $12^{\text{h}} 27^{\text{m}} 41^{\text{s}}$; it was observed by me at Camden Hill at $12^{\text{h}} 17^{\text{m}} 23^{\text{s}}.03$; giving, therefore, the difference of longitude between my Observatory and the Royal Observatory at Paris as $10^{\text{m}} 17^{\text{s}}.97$; now, the known difference is $10^{\text{m}} 8^{\text{s}}.26$; hence, this single observation gives the place of my Observatory relatively to the Paris Observatory within ten seconds of the truth. Whether an approximation to accuracy such as this is entirely to be scouted, upon the Superintendent’s authority, will require but little consideration.

Thirdly, I have no where said that the time of the eclipse was *not* inserted, nor that it was *not* correctly inserted; but it seems “it was inserted, and correctly inserted, with a view to the possibility of its being visible.” Was it so? Does the Superintendent think to be let off in this manner? Let me challenge him to explain the meaning of a black circular patch of about the tenth of an inch in diameter, which he has prefixed. Lest he should find this inconvenient, I will inform the reader, from page 162 of that year’s Almanac, that it means “the satellite was behind Jupiter, eclipsed by his body;” hence, therefore, nothing short of a miracle could have given that “possibility of its being visible,” under pretext of which the Superintendent so artfully seeks his shelter.

A French quotation is then enlisted, evidently for the sake of its last eight words ; “ Nous n’avons que trop d’observations douteuses ;” and was, no doubt, intended to be highly caustic. But whether my observations are or are not of an apocryphal character, has nothing to do with the great public question at issue ; and I will not therefore trespass on the reader’s time by repelling this insinuation, however unjust or malignant.

But “ the tone and style” in which the objections have been made are as little congenial to the Superintendent’s taste as are the objections themselves. Placed by him in the honourable post of generalissimo of the objectors, I will remind him, as briefly as I can, of the part I have taken, with respect to him, up to the present time. Early in 1818, finding that the procuring at the spur of the moment the corrections in right ascension of the thirty-six principal stars from Dr. Maskelyne was not only troublesome, but was frequently attended with error, I computed for my own use their corrections for every day of the year. Being seen from time to time by my astronomical friends, various applications were made for the loan of them ; hence they obtained considerable publicity, and in consequence of their acknowledged utility, it was buzzed about in certain quarters that the Almanac for 1822 would contain them. On the appearance, however, of this volume in the autumn of 1820, our expectations were but partly realised, for the apparent places of but twenty-four of them were given ; and those for every ten days only. I undertook, therefore, the computation of them for each of the thirty-six stars for every day in the year ; and with little interruption continued them till the end of 1825. They were published in Brande’s or Tilloch’s Journals, the first series appearing in the former on Jan. 1st, 1821. During this year it was proposed that these computations should be made at the expense of the Astronomical Society ; but as it was suggested, that the Board of Longitude might be induced to extend their calculations to the 46 stars, an application was made by some members of the Society to the Secretary of the Board and Superintendent of the Nautical Almanac, who answered, “ that it was not his intention to give any more in succeeding volumes than what were already given, namely, the apparent places of 24.” Upon this assurance the Society set to work, and produced the tables which stand in the first volume of its Memoirs, p. 436.

From them the corrections were procured, not only in right ascension, but also in declination, for the first two or three months of 1823, but which on comparison with those obtained from Maskelyne's tables, were found, in some instances, faulty; and the further publication of corrections was never resumed.

At the commencement of January 1822, at Sir Humphry Davy's, I applied to the Superintendent to have the goodness to ask the Board of Longitude to allow one of the Board's computers to calculate the transits of Jupiter's satellites and of their shadows over Jupiter's face, in order that I might ascertain how far the hint suggested by M. de Laplace was likely to prove advantageous in improving the theory of the satellites. The idea, however, the learned Superintendent ridiculed,—asking me what Laplace knew about the matter; and added, “as much is already known about the satellites as is needed.” I had mentioned that my attention had been called to the subject by reading Mr. Baily's pamphlet. Whether it was this accidental allusion to the pamphlet, containing Mr. Baily's “several severe remarks on the Nautical Almanac,” that nettled the Superintendent, I do not know; suffice it to say, the “tone and style” of his answer to me was very different to what I had formerly experienced.

As, however, I was not to be deterred by this equivalent to a refusal on the part of the Superintendent, and as Jupiter's position was most favourable for these delicate and difficult observations, I solicited Mr. Herschel to make a formal application for the calculations at the next Board of Longitude: he did so; the matter was referred to the resident members of the Board; and the calculations which I had in vain applied for to the Superintendent were ordered immediately. Some time after this, I met the Superintendent at Sir Humphry Davy's: he told me the calculations were ordered for me; but he thought I might as well have made them myself, for the labour would not have been excessive. In short, it was evident enough that I had earned his dissatisfaction by applying to the Board for that which I had been virtually refused by its Secretary. And I believe I may date the Superintendent's churlish answers to any suggestions I have since made to him from this unfortunate occurrence.

Early in March 1822, on a single night I observed the occultations of five stars by the moon; and but for the unfa-

avourableness of the weather should probably have seen several more. A few evenings afterwards, I mentioned the circumstance to Sir Humphry Davy, and with it my regret that the occultations of stars by the moon were not calculated in the Nautical Almanac, as well as in other Ephemerides. He entered warmly into the subject (as he ever did when the interests of astronomy were concerned); and the Superintendent arriving shortly afterwards, Sir Humphry introduced the matter to him. To my expression of regret, that information so important to astronomy and geography should be omitted, he indignantly exclaimed, "Do you think I am going to have occultations computed to gratify the idle curiosity of a few star-gazers about London?" The "style and tone" of this answer astonished me; and my reply was, "We have evidently different ideas of the object for which the Nautical Almanac was established; and the public must judge between us." After this I lost no time in getting together materials for an address to the public; and before the next meeting night at our excellent President's, the manuscript was ready for the press. At this meeting, however, the Superintendent, of his own accord, addressed me upon the subject, and frankly and voluntarily assured me that what he had said was not meant to apply to me personally. Thus was any little excitement I had felt instantaneously removed; and the public will judge of the spirit and feeling which actuated me, when I add, what was never known to more than two or three individuals, that the manuscript, which might have been sent to press the following morning, and which was written with some degree of severity, was committed to the flames. An individual who thus stops after he has advanced so far, cannot well be suspected of ungenerous feeling.

I had indeed sent to Mr. Brande's Journal a critique "on the chronometrical arrangements of the Admiralty at the Royal Observatory," wherein having demonstrated the extravagant terms on which the Admiralty had been induced by its scientific advisers to purchase chronometers, I used the following words: "Whilst the 400*l.* thus annually saved might be appropriated to some scientific purpose, and perhaps to no one better than restoring to its pristine excellence the Nautical Almanac and Astronomical Ephemeris." I began *de novo*, took the manuscript to Dr. Young, read it to him, offered to make any altera-

tions in it which he thought in the most indirect manner reflected upon him; and with pleasure do I remember that he objected not to a single word, and thanked me for the manner in which I had alluded to him. The pamphlet was distributed very generally among the Doctor's friends; and some of them unfortunately no more, as well as others still amongst us, congratulated me on having executed a difficult task with energy, yet without giving to any one occasion of offence. The book has long been before the public, and I readily leave its "tone and spirit" to their decision.

The next public appeal in which I engaged was published in the *Annals of Philosophy* for January and February 1824, and was entitled "An Inquiry how far it would be advisable that the daily corrections in right ascension and north polar distance of the 46 zero stars should be computed at the public expense." This was a subject where ample opportunity was offered to attack the Superintendent, seeing it was written in consequence of his former assertion, that the "Board of Longitude would give no more than they had already given, namely, the apparent places of 24."

This paper had its effect; for a very few days afterwards (namely on the 11th of March,) a council of the Royal Society was summoned, when, notwithstanding the recently-expressed sentiments of the Superintendent, the following resolution was carried:—"Resolved, That it is the opinion of the members of the council and of the resident commissioners of longitude present, that it would be highly conducive to the interests of practical astronomy, that a work should be printed containing tables of precession, aberration, solar nutation, and proper motion, for the sixty principal stars for every day in the period of four years, including leap year; and that a separate table should be given for the lunar nutation to every degree of the moon's node. These to serve as a permanent work, from which the annual corrections may be taken, for constructing periodical tables for every ten days."

The *Almanac* first published after the distribution of my paper, which led to this resolution of the council *and resident commissioners of longitude present*, contained the apparent places of the 60 stars, in lieu of 24; but obtained from sources, and constructed in a manner very different to that which the "coun-

cil and resident commissioners declared would be highly conducive to the interests of practical astronomy.”

In short, the printed work which the “council and resident commissioners” stated “would be highly conducive to the interests of practical astronomy,” has not yet been printed; and this non-compliance on the part of the Superintendent with the wish of these his friends and colleagues, would have furnished ample room for an attack, in which “tone and spirit” might have joined.

Towards the latter end of December 1823, at the President’s, the Superintendent said to me, “we shall not want any more of Mr. Baily’s improvements upon the calculations of the eclipses of Jupiter’s satellites; for next year they are computed in the Nautical Almanac from the same tables as are employed in the *Connaissance des Temps*.” This led to a further conversation, in which the Superintendent observed, that the differences between the old tables and the new ones of Delambre, as far as the first and second satellites were concerned, were not greater than the errors of observation; and as for those of the third and fourth, where the differences were greater, observations of them were of no use, and the omission of them altogether would be probably advisable. To this I gave my most earnest dissent. The following February, satisfactory observations, as well by Colonel Beaufoy as myself, afforded an opportunity of refuting the Superintendent’s ideas as to the inutility of observations of these two satellites; but although the paper on this subject was written in consequence of the Superintendent’s heterodox notions, neither “tone nor spirit” was raised against him.

Throughout the year 1824, I published in Mr. Brande’s *Journal* astronomical phenomena, arranged in the order of succession for every day of the year. This work, I know, was used daily in the principal observatories of Europe; and the preface to it would have afforded me an excellent opportunity for exhibiting a little “tone and spirit;” but the Superintendent was not even hinted at.

The paper published in the *Philosophical Transactions* in 1825, presented a very favourable opportunity for attacking the Superintendent, for the tail-piece of unfounded assertion contained in his Almanac of preceding and subsequent years; but the opportunity was not embraced.

At length, finding there was no probability of substantial

amendment in the Nautical Almanac, on the 30th of April last I addressed a letter to the *Times* newspaper, signed F.R.S. exposing to astronomical obloquy the carelessness with which the Ephemeris was published. In this, however, not an expression can be found directed personally against the Superintendent; I attacked the Board of Longitude *en masse*, as I had previously done, and as I would have gone on doing, till it should have reformed its conduct. When that Board was dissolved, I was in hopes that some steps would be taken to regenerate the Nautical Almanac; but these hopes were soon destroyed; for on my first seeing the Superintendent after the Board's dissolution, it was evident enough that his sentiments, as to any improvements, were perfectly unchanged.

In my letter to the *Times* newspaper of October 30th, of last year, relative to Encke's comet, not one word was said of the Superintendent.

To this an anonymous answer appeared in the *Morning Chronicle* of Nov. 17th, attempting to throw the onus upon individuals or societies, who had no more to do with the Nautical Almanac, than the man in the moon. This injudicious answer should have remained unnoticed, but for a fear that had it been unrefuted, any hopes that the Government would open its eyes to the lost astronomical character of the country would be destroyed. Hence it was that, at the suggestion of some of my friends, the "Reply to the Letter in the *Morning Chronicle*" was written. In it I expressed myself as I felt, warmly; I asserted astronomical facts, and how has the Superintendent met them?

"To conclude: it may safely be asserted of the whole of the objections which have been advanced against the Nautical Almanac, that they may be very readily answered by the person whom they are intended to affect, while they are likely to do incalculable mischief to nautical men, who may not have leisure, nor perhaps always ability, to examine them, by robbing them of their confidence in those means of security with which the long-continued care of a liberal Government has at last effectually provided them.

(Signed) "THOMAS YOUNG,
"Superintendent of the Nautical Almanac."

Unable to contradict the matter contained in the Memorandum, the Superintendent in a previous paragraph had attacked the manner, and would fain have it believed that some unworthy motive had influenced those gentlemen who took an active part in that representation to Government; so, in his concluding paragraph, he ventures to insinuate that our efforts to improve the Nautical Almanac were intended “to affect” him personally. In this attempt, however, I trust that he has not proved more successful than in his Defence: and if it should be thought by any of my readers that he has been treated with some severity, be it remembered, that he did not confine himself to the mere vindication of the Nautical Almanac, but that he accused us of making “a number of objections,” not only “unimportant,” but even “unfounded.”

The “Memorandum” originally presented to the Chancellor of the Exchequer,—the Superintendent’s “Answers,”—and my “Refutation” of their mistatements, now stand fairly before the public; and, on reconsidering the whole dispassionately, I cannot find a single charge against the Nautical Almanac disproved,—a single statement of his Reply justified,—or a single expression of mine to retract. If, then, the Nautical Almanac is to be considered a national work, we may, I think, assume that it must undergo a substantial amendment. The plan indeed best adapted to ensure that amendment, is not for me, but for the Government to determine.

I feel that the scientific character of my Country has been for some time on the decline; that scientific character which has long been one of the best supports to the proud attitude which this Country has maintained, now totters; and should it at length fall a victim to the apathy of the public, and to the venal indolence of those who cultivate science not for its honours, but for its rewards,—I at least shall have the satisfaction of feeling that I have done my duty.

Science, in this Country, has no sanctuary. To provide one, would be worthy of the Vanquisher of Napoleon, the Pacificator of Ireland, and the Successor of William Pitt.

APPENDIX.

INSTRUCTION PUBLIQUE.

RAPPORT

*Sur l'établissement du Bureau des Longitudes, par Grégoire.
Séance du 7 Messidor, l'an 3 de la République une et indivisible (25 Juin, 1795); suivi du Décret de la Convention Nationale, et imprimé par son ordre.*

JE viens au nom de vos comités de marine, des finances, et d'instruction publique, vous proposer l'établissement d'un bureau des longitudes.

L'exposé des raisons qui motivent cette demande, prouvera l'indispensable nécessité de ce moyen, pour faire fleurir notre marine.

Themistocles disoit : Quiconque est maître de la mer, l'est de la terre.

Un de nos poètes exprimoit la même idée à sa manière, en disant

Le trident de Neptune est le sceptre du monde.

Les succès des Anglais, à diverses époques, et spécialement dans la guerre de 1761, n'ont que trop prouvé que la supériorité de la marine décide souvent des résultats de la guerre.

Une des mesures les plus efficaces, pour étouffer la tyrannie Britannique, c'est de rivaliser dans l'emploi des moyens par lesquels cet état, qui ne devoit jouer qu'un rôle secondaire dans l'ordre politique, est devenu une puissance colossale.

Or les Anglais bien convaincus que sans astronomie on n'avoit ni commerce, ni marine, ont fait des dépenses incroyables pour pousser cette science vers le point de perfection.

Si j'avois à rappeler tous les bienfaits de l'astronomie, je dirois que, sans elle, les hommes n'auroient jamais eu la véritable mesure du temps. L'ignorant sait-il que l'exactitude de son calendrier résulte des observations les plus profondes sur l'état du ciel ?

L'astronomie a débrouillé le chaos des âges ; sans elle, plusieurs écrivains anciens eussent été incompréhensibles. On sait combien elle a prêté de secours aux auteurs de *l'art de vérifier les dates*, l'un des meilleurs ouvrages de notre siècle, et quel jour Pingré a jeté sur l'histoire par la chronologie des éclipses, fondée sur l'ordre invariable du mouvement des corps célestes.

A côté de la halle au bled, un monument existe encore ; il atteste la superstition d'une femme qui croyoit à l'astrologie, et qui ne croyoit point à la vertu.

Les météores, les aurores boréales, et les comètes, ont conservé, presque jusqu'à nos jours, le privilège d'effrayer la terre.

Les efforts de Bayle et d'autres philosophes, pour guérir ces maladies de l'esprit humain, ne furent pas un petit service rendu à la société, si l'on considère combien il importe de la sortir de l'enfance, et combien les rêveries astrologiques ont influé sur le sort des nations.

Enfin, sans l'astronomie, la géographie seroit encore au berceau ; c'est en rapprochant les observations célestes, les expériences faites à diverses latitudes sur la gravité et les mesures de diverses degrés du méridien, qu'on a déterminé la figure de la terre, et révélé le vrai système du monde.

Mais le point de vue sous lequel il nous importe surtout de considérer l'astronomie, c'est relativement à son influence sur la marine et le commerce, qui firent la gloire et la richesse de la Phénicie, de Rhodes, et de Carthage. A son aide, des flottes marchandes cinglèrent d'Aziongaber à Ophir. Hannon, dans une course de vingt-six jours, poussa jusques vers le Sénégal, et consigna son voyage dans le Periple, dont il nous reste l'abrégé.

Un astronome qui, le premier, distingua les climats par les différentes longueurs des jours et des nuits, et qui fut le plus hardi navigateur de l'antiquité, étoit né parmi nous.

Il y a 22 siècles que Pythéas (de Marseille) passa le détroit de Gibraltar, et parvint jusqu'à l'Islande ; dans un second

voyage, il entra dans la Manche, passa le Sund, et pénétra dans la Baltique.

Cependant, les plus célèbres marins de l'antiquité ne furent guère que d'excellens caboteurs, parce que l'audace des entreprises étoit subordonnée à la mesure peu étendue de leurs connoissances astronomiques ; à peine osoient-ils perdre de vue les côtes. La mer Atlantique et l'océan Pacifique n'avoient pas vu de citadelles flottantes errer sur les eaux, jusqu'à l'époque où, par le moyen de la boussole et de nouvelles observations astronomiques, de nouveaux Pythéas s'aventurèrent au large, doublèrent le Cap des Tempêtes, et ouvrirent au commerce de nouvelles routes.

Alors les productions naturelles et industrielles de tous les pays, circulèrent dans le globe ; alors s'accrut l'horison de la pensée : un grand pas fut fait vers la civilisation générale. De nouvelles branches de la famille humaine apprirent à se connoître ; elles purent étendre, les unes vers les autres, les bras de la fraternité, et dans les communications d'une amitié réciproque, puiser des jouissances nouvelles.

Mais la déclinaison de l'aiguille aimantée varie, comme tout le monde sait, suivant les lieux et les temps, et partant les cartes magnétiques seront toujours insuffisantes. Le compas de route, ni le loch, n'indiquent pas si la marche du vaisseau a été accélérée ou retardée, s'il a été détourné par la dérive ou par quelque courant. Avec ces instrumens, le navigateur ne peut se passer de l'astronomie ; l'astronomie pourroit absolument se passer d'eux. La découverte des satellites de Jupiter, en perfectionnant les cartes marines, a suffi pour produire une révolution dans l'esprit humain et dans les relations commerciales et diplomatiques.

La découverte la plus importante, qui avoit d'abord été considérée comme une chimère, et qui a beaucoup exercé les mathématiciens des deux derniers siècles, est la détermination des longitudes en mer. Le problème est ceci : connoissant l'heure du vaisseau, savoir l'heure du premier méridien convenu, ou du lieu du départ ; la différence des heures réduites en parties de l'équateur, donne la longitude du navire, en la rapportant au méridien choisi pour terme de comparaison. On compte sur l'équateur quinze degrés pour une heure, et conséquemment quatre minutes pour un degré.

Ce problème a été l'objet des méditations et des recherches d'une société célèbre, dont les travaux sont devenus la propriété de tous les peuples éclairés, de l'Académie des Sciences de Paris.

Presque toutes les nations qui fréquentent la mer, ont ouvert des concours relatifs aux longitudes ; mais rien n'égale ce qu'a fait l'Angleterre à cet égard.

En 1714, à Londres, fut formé un comité auquel on appela les plus grands hommes de cette contrée : Newton étoit du nombre. C'est là, dit Fleurieu, qu'on fixa les limites de l'erreur ; et d'après la délibération du comité, le parlement publia un bill solennel, pour inviter les savans et les artistes de toutes les nations à s'occuper du problème des longitudes : un prix de vingt mille livres sterling fut proposé pour celui qui trouveroit la longitude à un demi degré près.

D'autres sommes moins considérables furent assignées, tant pour des tables solaires et lunaires, que pour des découvertes moins importantes.

L'horlogerie, la mécanique, la géométrie, l'astronomie, ont disputé la gloire de résoudre ce problème : toutes se sont assurées des droits à la gratitude des nations. Tandis que l'astronomie perfectionnoit ses méthodes pour mesurer les distances de la lune au soleil et aux étoiles, ce qui lui donne la différence des méridiens, l'horlogerie exécutoit les montres marines, dont l'idée n'étoit pas neuve, mais dont l'application l'étoit.

Le gouvernement Anglais accorda des sommes exorbitantes, soit pour faire imprimer les nouvelles méthodes, soit pour récompenser Bird, Ramsden, et surtout Harrison, dont les montres furent essayées avec succès dans divers voyages aux Barbades et à la Jamaïque.

En France, deux rivaux illustres entrèrent en lice : l'un étoit Léroï, fils de Julien Léroï, frère de celui à qui Voltaire disoit : *Votre père et Maurice de Saxe ont battu les Anglais* ; l'autre étoit Ferdinand Berthoud, à qui nous devons savoir gré d'avoir adopté la France pour sa nouvelle patrie.

A diverses reprises, le gouvernement arma à grand frais des corvettes et des frégates, pour soumettre à l'examen, dans des voyages de long cours, les nouveaux moyens présentés pour déterminer les longitudes en mer. Ces expéditions rappellent avec intérêt les noms de Courtanveaux, Verdun, Borda, Fleurieu,

Pingré, Rochon, et Chappe ; le neveu de ce dernier a lié son nom au Télégraphe, dont Amontons avoit donné l'idée.

Il résulte de ces expériences, que, malgré l'agitation du vaisseau, la variation des frottemens, la différence de température, et les autres causes accidentelles, ces montres marines, surtout celle de Ferdinand Berthoud, conservèrent une justesse que l'art n'avoit pas encore atteinte.

Après une traversée de six semaines, la somme des écarts n'excédoit pas deux minutes de temps, ou un demi degré en longitude. Ce demi degré équivaloit à dix lieues, sous l'équateur ; à huit lieues deux tiers, sous le parallèle de trente degrés ; à sept, sous celui de quarante-cinq ; et à cinq, sous celui de soixante. Nos collègues Faure et Trehouard ont constaté (et ce fait est précieux à recueillir) que dans une dernière sortie de trente-sept jours, la montre de Berthoud a donné la longitude à trois lieues près.

Si ce n'est point encore le dernier terme de la perfection, c'est jusqu'à présent le dernier effort de la sagacité des savans et des artistes ; et certes, ils sont les bienfaiteurs de la société. Ils ont épargné à l'humanité des regrets et des larmes, en diminuant de beaucoup les chances malheureuses des expéditions nautiques.

Au retour d'un voyage dans l'Amérique Méridionale, en 1735, Don Ulloa imprimoit encore à Madrid, que la différence de deux et même trois degrés sur la longitude en mer, n'étoit pas réputée une erreur considérable :* et si, plus heureuses que les expéditions de la Peyrouse et d'Entrecasteaux, les corvettes expédiées en 1789 sont rentrées récemment dans les ports de l'Espagne, devenue notre ennemie, c'est peut-être au génie Français qu'elle doit cet avantage ; car le génie, par ses bienfaits, est cosmopolite ; ses découvertes sont l'héritage du genre humain, et les travaux de ces hommes occupés à défricher les routes de la science, à prendre la nature sur le fait, suivant l'expression de Fontenelle, préparent en silence, et assurent les destins des nations.

L'envoi d'un aviso en temps de guerre, peut compromettre le succès d'une bataille et le salut d'une colonie, si l'ignorance du pilote fait manquer sa route et retarde son arrivée. C'est faute de lumières que plusieurs bâtimens allant attérer à l'isle Rodrigue

* *Relacion Historica del Viage a la America Meridional, &c. por Juan y Ulloa, tom i. p. 19.*

pour gagner le vent, au lieu de se porter directement aux isles de France ou de la Réunion, ont été capturés par des croiseurs Anglais.* Par suite d'ignorance semblable, n'a-t-on pas vu un vaisseau destiné pour l'Isle-de-France aborder à la côte de Malabar ?

On se rappelle le trait de l'amiral Anson, dont l'incertitude sur la position de l'isle Juan-Fernandez, en l'obligeant à tenir la mer plus long-temps, coûta la vie à 70 ou 80 hommes de son équipage.

La prospérité du commerce, la sûreté de nos vaisseaux, vous intéressent ; la vie des marins vous est chère, et vous ne voulez pas qu'elle soit abandonnée aux erreurs d'hommes, qui, incapables de s'assurer du lieu du vaisseau à chaque instant du jour et de la nuit, de connoître la longitude et la latitude des points de relâche, le gisement des côtes, iroient se briser contre des écueils.

Vous avez quelques officiers, quelques pilotes très-éclairés : il faut en accroître le nombre, si l'on veut faire oublier les naufrages qui ont affligé la marine Française.

Il faut leur donner des règles sûres et applicables dans toutes les circonstances. Il faut, en quelque sorte, vulgariser la science en leur communiquant des méthodes promptes et faciles, pour

* En 1779, Trémigon, capitaine de vaisseau, fut expédié de Brest, sur le Bizare, de 64, pour se rendre à l'Isle-de-France.

L'équipage et l'état-major éprouvèrent une maladie si contagieuse, qu'à son arrivée à Falsbaye, les débris du convoi de M. Duchillaud furent obligés de lui envoyer du monde pour serrer ses voiles et s'amarer.

Après une relâche assez longue, on lui forma un nouvel équipage aux dépens du convoi, avec lequel il partit pour se rendre à sa destination. Mais les hommes sains et robustes qu'on lui avoit donnés, ayant été atteints de la maladie, dont le germe étoit resté à bord du vaisseau, il se détermina à se séparer du convoi, et Malavois, élève de Lalande, qui alloit en qualité d'ingénieur dans l'Inde, au moyen des observations de longitude, le fit attérer droit sur l'Isle-de-France, au lieu d'aller prendre connoissance de Rodrigue, comme cela se pratique encore aujourd'hui, quoique cette isle soit à cent lieues au vent de l'autre.

Le Bizarre gagna huit jours par ce moyen sur le convoi : combien d'hommes, dans cet intervalle de temps, eussent péri ! quoique la maladie ne fût pas à son dernier période, elle les moissonnoit par centaine chaque jour. — *Note communiquée par Faure (de la Creuse), représentant du peuple.*

simplifier les calculs, et par-là même dompter les fureurs de la mer, et tromper les caprices de cet élément.

Depuis 1767, les Anglais publient leur *Nautical Almanach*, dont l'idée est due aux Français ; car, lorsque Maskeline, revenu de Sainte-Hélène, le proposa, il ne fit qu'adopter l'idée présentée en 1755 par la Caille. Cet ouvrage, devenu le manuel de leurs marins, paroît cinq et même six ans à l'avance, tandis que chez nous, à l'époque actuelle, *la Connaissance des Temps* n'est imprimée que pour l'année courante, et vous seriez dans l'impossibilité de donner cet ouvrage indispensable à des marins, si dans ce moment on entreprenoit quelque voyage de long cours.

Mais aussi, la confection du *Nautical Almanach* est confiée à un établissement pour lequel les Anglais n'ont rien épargné, à un bureau des longitudes tel que celui dont vos comités vous proposent la formation. Ce bureau fera, chaque année, un cours public d'astronomie ; il vérifiera tous les instrumens nautiques destinés pour notre marine ; il sera chargé de rédiger *la Connaissance des Temps*, de manière qu'on ait toujours plusieurs années à l'avance ; il perfectionnera les tables astronomiques et les méthodes de longitudes, les cartes magnétiques et surtout les cartes hydrographiques, dont un grand nombre sont encore très-vicieuses, celles surtout de la Méditerranée, ce qui intéresse essentiellement votre commerce du Levant.

Telle est leur imperfection, que, pour l'Anacharsis de Barthelemy, les cartes ont été faites d'après des plans levés à la boussole. La mer Caspienne, avec le pays adjacent, est encore si peu connue, que quelques géographes ont varié de cinq degrés sur sa position. Le citoyen Beauchamps, qui a laissé son observatoire à Bagdat, et qui est nommé consul à Mascate, espère rectifier ces erreurs dans le cours d'un voyage, dont le commerce et l'astronomie se promettent de grands avantages.

Le bureau des longitudes s'occupera également de la météorologie, science peu avancée ; et cependant les résultats de cette branche des connoissances humaines importent singulièrement à l'agriculture. On sait avec quel succès ils ont été appliqués par Duhamel à la botanique, par Malouin à la médecine, par Deluc à mesurer la hauteur des montagnes.

L'Observatoire de Paris, le plus beau monument élevé à l'astronomie, est presque désorganisé. Plusieurs des membres

vont dans la Belgique, mesurer des triangles, tandis que pour compléter l'arc de neuf degrés et demi, dont la mesure est commencée, Delambre va reprendre les opérations géodésiques depuis Orléans, en continuant vers les Pyrénées ; et des Pyrénées, Méchain s'avancera vers lui en continuant les travaux du même genre. Par l'établissement du bureau des longitudes, l'Observatoire se trouve réorganisé.

Dans divers départemens, vous avez des observatoires. A Lyon, Dijon, Montauban, Marseille, Toulouse, etc. ; et de bons observateurs, tels que Jacques, Darquier, Duc-la-Chapelle, le Roy, et autres. Le bureau proposera les observatoires qui doivent être conservés. Et certes, dans ce nombre, ne seront point oubliés les ports de Brest et Toulon, qui sont les principaux arsenaux des forces maritimes de la République, où les besoins de la marine commandent impérieusement l'établissement d'observatoires. A Brest, le local et les instrumens n'attendent qu'une légère dépense pour la bâtisse, et là vous avez pour astronome un homme dont le nom appelle la confiance, le citoyen Rochon.

Sans doute vous favoriserez également l'établissement d'un atelier pour la fabrication des lunettes à Brest, où l'on peut presque toujours se procurer par des prises Anglaises le *flintglass* nécessaire à leur confection. D'ailleurs les lunettes de Paris, quoiqu'excellentes, et fabriquées par des artistes très-habiles, ne conviennent pas toujours à la marine, parce que ceux qui observent à terre n'ont pas à redouter l'inconvénient qui résulte des roulis et du tangage des vaisseaux, et que l'horison sur mer présente un aspect différent de celui de terre.

Si l'on accorde à Ferdinand Berthoud un logement au Louvre, où cet artiste puisse déployer son atelier, il se propose de rendre de nouveaux services à sa patrie, en formant gratuitement des élèves pour la construction des horloges marines, alors les moyens de perfectionner la science seront réunis ; et tandis qu'en ouvrant des canaux vous créerez la navigation intérieure, le bureau des longitudes, par ses travaux, ses observations, et la correspondance avec les savans, tant nationaux qu'étrangers, rassemblera en un faisceau toutes les lumières propres à éclairer et à diriger la navigation extérieure.

Il est instant de réparer le gnomon de Tonnerre, ce qui peut se faire avec très-peu de frais.

Vous réaliserez le projet d'un télescope à la manière d'Herschel, ayant 60 pieds de long, sur 6 pieds de diamètre.

La royauté avoit souillé tout ; la République purifiera tout. Depuis la fin du seizième siècle, toutes les nations ont emprunté des Français l'usage de marquer le Nord par une fleur-de-lis, tant sur les compas de route, que sur toutes les cartes hydrographiques, et même sur les cartes géographiques qui embrassent trop peu d'espace, pour qu'on puisse y tracer les méridiens et les parallèles. On ne connoît guère d'exception à cet usage, que dans les nouvelles cartes du Kattegat, de la Baltique, et du golfe de Finlande, par Nordenankars. Des emblèmes plus convenables à la liberté remplaceront les signes du despotisme.

Le moment n'est pas éloigné, sans doute, où les nations abjurant les puérités de l'orgueil, adopteront pour méridien commun, celui que Ptolomée avoit fixé à la plus occidentale des isles Canaries.

Le bureau des longitudes, à Londres, est composé au moins de dix-huit membres, dont six sont les lords de l'amirauté : celui de Paris sera moins nombreux ; dix membres et quatre adjoints ; vos comités vous proposent des hommes que l'Europe nous envie, qui sont créanciers de la posterité, et dont le choix sera une réparation éclatante des outrages faits par les barbares, les contre-révolutionnaires que soldoit l'étranger, aux sciences, et à ceux qui les cultivent.

Quant aux dépenses, nous ne rappellerons pas celles qu'ont faites les autres peuples, et même les Chinois, pour l'érection d'un magnifique observatoire ; ce qu'ont fait deux tyrans de la France pour l'avancement de l'astronomie. Sous Louis XIV, la méridienne et la perpendiculaire furent tracées. Sous Louis XV, des colonies de savans se partagèrent en quelque sorte le globe, pour observer le passage de Vénus, pour mesurer des degrés terrestres ; les uns à l'isle Rodrigue, au cap de Bonne-Espérance, en Californie ; les autres en Laponie, au Pérou.

Il faut défalquer sur les dépenses nouvelles qu'occasionera cet établissement, celle qu'entraînoit l'Observatoire, puisqu'il sera désormais dans son attribution.

D'ailleurs, nous vous dirons qu'en fait d'économie, dépenser à propos, c'est épargner.

On objectera peut-être que, dans les lois organiques rela-

tives à la partie de la constitution, qui a pour objet l'instruction publique, cet article trouvera sa place ; il l'y trouvera sans doute, et même notre projet est conçu de manière à être casé dans ce plan ; mais le moment, où d'après les bases constitutionnelles, le bureau des longitudes pourroit être organisé, est encore lointain, tandis qu'il s'agit d'une chose urgente. Si vous pensez que l'ajournement soit nécessaire à la discussion, qu'au moins il soit prochain. N'ajournons pas indéfiniment les moyens de prospérité de la République ; vous accroîtrez ces moyens propres à hâter le bonheur de la race humaine, et vous léguerez ce dépôt aux générations qui nous suivront et qui nous jugeront.

Nous finirons par ces paroles d'un savant, qui, après avoir siégé parmi les législateurs, fut assassiné sous le régime de la tyrannie. En astronomie, il reste, dit Bailly, un grand nombre de questions à débrouiller ; ce sera l'œuvre du temps et la moisson de la postérité.*

Voici le projet de décret :

La Convention nationale, après avoir entendu le rapport de ses comités de marine, des finances, et d'instruction publique, décrète :

ARTICLE I. Il sera formé un bureau des longitudes.

II. Il aura, dans son attribution, l'observatoire national de Paris, et celui de la ci-devant école militaire, les logemens qui y sont attachés, et tous les instrumens d'astronomie qui appartiennent à la nation.

III. Il indiquera aux comités de marine et d'instruction publique, pour en faire un rapport à la Convention Nationale, le nombre des observatoires à conserver ou à établir au service de la République.

IV. Il correspondra avec les autres observatoires, tant de la République que des pays étrangers.

V. Le bureau des longitudes est chargé de rédiger *la Connaissance des Temps*, qui sera imprimée aux frais de la République, de manière qu'on puisse toujours avoir les éditions de plusieurs années à l'avance ; il perfectionnera les tables astronomiques, et les méthodes des longitudes, et s'occupera de la publication des observations astronomiques et météorologiques.

* Histoire de l'Astronomie ancienne ; discours préliminaire, p. 111.

VI. Un des membres du bureau des longitudes fera chaque année un cours d'astronomie.

VII. Il rendra annuellement un compte de ses travaux, dans une séance publique.

VIII. Le bureau des longitudes est composé de deux géomètres, quatre astronomes, deux anciens navigateurs, un géographe, et un artiste pour les instrumens astronomiques.

IX. Le bureau des longitudes est composé ainsi qu'il suit :

Géomètres : *Lagrange, Laplace.*

Astronomes : *Lalande, Cassini, Mechain, Delambre.*

Anciens navigateurs : *Borda, Bougainville.*

Géographe : *Buache.*

Artiste : *Carocher.*

X. Les membres composant le bureau des longitudes, feront leur règlement, qui sera soumis à l'approbation des comités de marine et d'instruction publique.

XI. Le bureau des longitudes nommera aux places vacantes dans son sein.

XII. Il y aura quatre astronomes adjoints, également nommés par le bureau, pour travailler, sous sa direction, aux observations et aux calculs.

XIII. Le traitement des membres composant le bureau des longitudes est fixé à huit mille livres; celui des adjoints à quatre mille livres.

XIV. Une somme de douze mille livres est affectée annuellement pour l'entretien des instrumens, les frais de bureau, et autres dépenses courantes.

XV. Les dépenses de cet établissement seront prises sur les fonds mis à la disposition de la commission d'instruction publique.

XVI. Il sera pris dans les dépôts de livres appartenans à la nation, et dans les doubles de la bibliothèque nationale, les livres nécessaires pour compléter la bibliothèque astronomique, commencée à l'observatoire.

(Adopté.)

LOI
PORTANT ÉTABLISSEMENT
D'UN
BUREAU DES LONGITUDES.

*Du 7 Messidor, l'an 3^e de la République une et indivisible
(25 Juin, 1795, ancien style).*

LA Convention nationale, après avoir entendu le rapport de ses comités de marine, des finances, et d'instruction publique, décrète :

ARTICLE I. Il sera formé un bureau des longitudes.

II. Il aura, dans son attribution, l'observatoire national de Paris, et celui de la ci-devant école militaire, les logemens qui y sont attachés, et tous les instrumens d'astronomie qui appartiennent à la nation.

III. Il indiquera aux comités de marine et d'instruction publique, pour en faire un rapport à la convention nationale, le nombre des observatoires à conserver ou à établir au service de la République.

IV. Il correspondra avec les autres observatoires, tant de la République que des pays étrangers.

V. Le bureau des longitudes est chargé de rédiger *la Connaissance des Temps*, qui sera imprimée aux frais de la République, de manière qu'on puisse toujours avoir les éditions de plusieurs années à l'avance : il perfectionnera les tables astronomiques et les méthodes des longitudes, et s'occupera de la publication des observations astronomiques et météorologiques.

VI. Un des membres du bureau des longitudes fera chaque année un cours d'astronomie.

VII. Il rendra annuellement un compte de ses travaux, dans une séance publique.

VIII. Le bureau des longitudes est composé de deux géomètres, quatre astronomes, deux anciens navigateurs, un géographe, et un artiste pour les instrumens astronomiques.

IX. Le bureau des longitudes est composé ainsi qu'il suit :

Géometres : *Lagrange, Laplace.*

Astronomes : *Lalande, Cassini, Mechain, Delambre.*

Anciens navigateurs : *Borda, Bougainville.*

Géographe : *Buache.*

Artiste : *Caroché.*

X. Les membres composant le bureau des longitudes, feront leur règlement, qui sera soumis à l'approbation des comités de marine et d'instruction publique.

XI. Le bureau des longitudes nommera aux places vacantes dans son sein.

XII. Il y aura quatre astronomes adjoints, également nommés par le bureau, pour travailler, sous sa direction, aux observations et aux calculs.

XIII. Le traitement des membres composant le bureau des longitudes est fixé à huit mille livres ; celui des adjoints à quatre mille livres.

XIV. Une somme de douze mille livres est affectée annuellement pour l'entretien des instrumens, les frais de bureau, et autres dépenses courantes.

XV. Les dépenses de cet établissement seront prises sur les fonds mis à la disposition de la commission d'instruction publique.

XVI. Il sera pris dans les dépôts de livres appartenant à la nation et dans les doubles de la bibliothèque nationale, des livres nécessaires pour compléter la bibliothèque astronomique, commencée à l'observatoire.

Visé par le représentant du peuple, inspecteur aux procès-verbaux.

(Signé)

ENJUBAULT.

Collationné à l'original, par nous, président et secrétaires de la Convention Nationale. A Paris, le 9 Messidor, an troisième de la République Française, une et indivisible.

(Signé)

LOUVET (du Loiret), *Président.*

DELECLOY, J. MARIETTE, *Secrétaires.*

RÈGLEMENT

DU

BUREAU DES LONGITUDES.

Extrait du Registre des Délibérations du Comité d'Instruction publique, ce 4^e jour complémentaire, an troisième de la République Française, une et indivisible, (20 Septembre, 1795, ancien style.)

Le comité, après s'être concerté avec le comité de marine et des colonies, relativement au règlement du bureau des longitudes, établi par la loi du 7 Thermidor, an 3, arrête ce qui suit :

ARTICLE I. Le bureau s'assemblera deux fois par décade, le duodi et le septidi.

II. Les adjoints astronomes assisteront à ses séances, et auront voix délibérative pour ce qui concerne les sciences.

III. Son assemblée publique aura lieu chaque année, le 2 du mois Floréal ; elle sera destinée à rendre compte de ses travaux, et des progrès de l'astronomie et de la navigation.

IV. Il nommera, tous les trois mois, parmi ses membres, et à la pluralité relative, un président, un secrétaire, et un trésorier ; le premier ne pourra être ré-élu qu'après une année d'intervalle.

V. Les élections de ses membres, et celles des adjoints, seront indiquées trois séances d'avance : elles ne pourront avoir lieu à moins qu'il n'y ait sept membres présents, et elles se formeront de cette manière : le bureau formera d'abord une liste des candidats, ensuite chaque membre écrira sur son billet les noms de ces candidats, suivant l'ordre de mérite qu'il leur suppose : il n'écrira rien vis-à-vis du dernier nom ; il écrira 1 vis-à-vis du nom supérieur, 2 vis-à-vis du nom au-dessus, et ainsi du reste. Le président, le trésorier, et le secrétaire feront la somme des nombres relatifs à chaque candidat, et celui qui aura la plus grande somme sera élu.

VI. Si le bureau juge à l'unanimité qu'un adjoint doive être destitué, il adressera son avis motivé au directoire exécutif, qui prononcera la destitution s'il y a lieu.

VII. Quatre fois par an, les membres du bureau feront une visite générale de l'observatoire national, et de celui de l'école militaire; ils en dresseront procès-verbal, ainsi que de l'état des instrumens. Ce procès-verbal sera communiqué au directoire exécutif, avec l'avis du bureau sur les changemens et augmentations, qu'ils croiront utile de faire à ces établissemens.

VIII. Ils présenteront aussi au directoire exécutif l'état des améliorations à faire aux observatoires des départemens.

IX. Le bureau présentera, chaque année, au corps législatif un annuaire propre à régler ceux de toute la République.

Expédition du présent arrêté sera envoyée au bureau des longitudes.

Pour extrait conforme : Paris, ce 6^e jour complémentaire de l'an 3^e de la République Française.

(Signé) DRULHE, *Président.*

GREGOIRE, DELEYRE, LANTHENAS, BARAILLON,
BORDES, CREUZÉ-PASCAL, WANDELAINCOURT.

(Certifié conforme)

LALANDE, *Secrétaire du Bureau des Longitudes.*

LONDON:

J. MOYES, TOOK'S COURT, CHANCERY LANE.